DOCUMENT RESUME

ED 397 319 CE 072 204

TITLE	Mississippi Curriculum Framework for Diesel Equipment Technology (CIP: 47.0605--Diesel Engine Mechanic & Repairer). Postsecondary Programs.
INSTITUTION	Mississippi Research and Curriculum Unit for Vocational and Technical Education, State College.
SPONS AGENCY	Mississippi State Dept. of Education, Jackson. Office of Vocational and Technical Education.
PUB DATE	1 Aug 95
NOTE	89p.; Former title: Heavy Equipment Maintenance Technology. For related documents, see CE 072 162-231.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	*Auto Mechanics; Behavioral Objectives; Community Colleges; Competence; *Competency Based Education; Core Curriculum; *Diesel Engines; Educational Equipment; Hand Tools; Leadership; Motor Vehicles; Repair; *Small Engine Mechanics; State Curriculum Guides; Statewide Planning; Technical Institutes; Two Year Colleges
IDENTIFIERS	Mississippi

ABSTRACT

This document, which is intended for use by community and junior colleges throughout Mississippi, contains curriculum frameworks for the course sequences in the diesel equipment technology programs cluster. Presented in the introductory section are a description of the program and suggested course sequence. Section I lists baseline competencies, and section II consists of outlines for each of the following courses in the sequence: fundamentals of equipment mechanics; hydraulic brake systems; electrical/ electronic systems; power trains; hydraulics; diesel fuel systems; preventive maintenance and service; engine rebuilding; computerized engine controls systems; advanced brake systems; steering and suspension systems; air conditioning and heating systems; engine troubleshooting and tune-up; auxiliary systems components; special project in diesel equipment technology; supervised work experience in diesel equipment technology; welding for diesel equipment technology; transport refrigeration; and fluid power trains; plus a related vocational-technical course in fundamentals of electronics. Each course outline contains some/all of the following: course name and abbreviation; course classification; course description; prerequisites; and competencies and suggested objectives. Recommended tools and equipment are listed in section III. Appended are lists of related academic topics and workplace skills for the 21st century and student competency profiles for both courses. (KC)

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Mississippi Curriculum Framework for Diesel Equipment Technology

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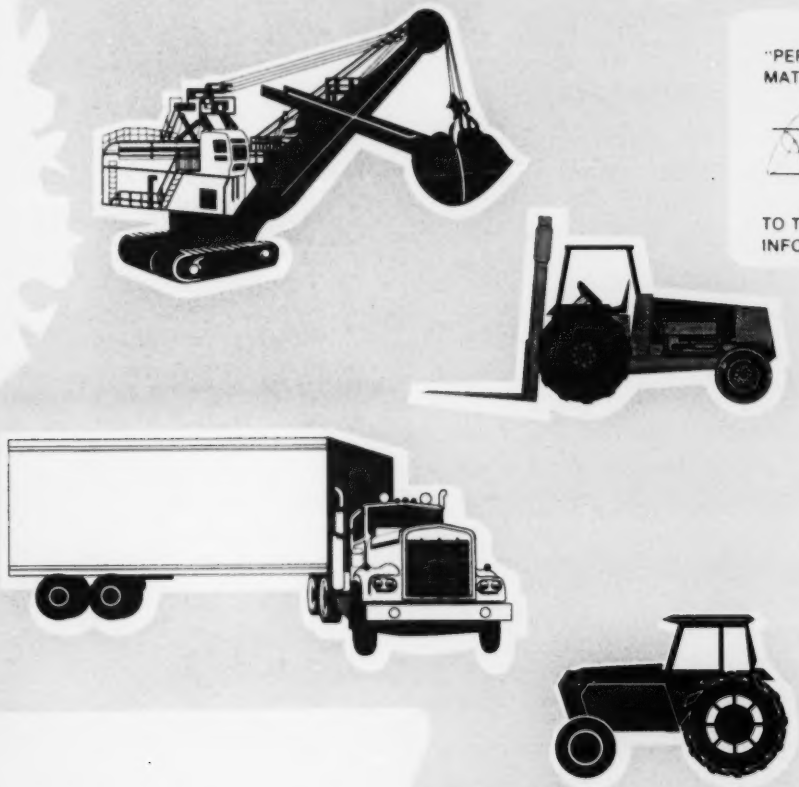

Postsecondary
Vocational and Technical Education
1995

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MISSISSIPPI

CURRICULUM FRAMEWORK

FOR

DIESEL EQUIPMENT TECHNOLOGY
(FORMERLY HEAVY EQUIPMENT MAINTENANCE TECHNOLOGY)

(CIP: 47.0605 - Diesel Engine Mechanic & Repairer)

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Published by the:

Office of Vocational and Technical Education
Mississippi Department of Education
Jackson, Mississippi

Research and Curriculum Unit for Vocational and Technical Education
Mississippi State University
Mississippi State, Mississippi

1995

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FOREWORD

In order to survive in today's global economy, businesses and industries have had to adopt new practices and procedures. Total quality management, statistical process control, participatory management, and other concepts of high performance work organizations are practices by which successful companies survive. Employers now expect their employees to be able to read, write, and communicate effectively; solve problems and make decisions; and interact with the technologies that are prevalent in today's workplace. Vocational-technical education programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflect these changes in the workplace and a number of other factors that impact on local vocational-technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U. S. Departments of Education and Labor, provide vocational educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses which focus on the development of occupational competencies. Each vocational-technical course in this sequence has been written using a common format which includes the following components:

- Course Name - A common name that will be used by all community/junior colleges in reporting students.
- Course Abbreviation - A common abbreviation that will be used by all community/junior colleges in reporting students.
- Classification - Courses may be classified as:
  - Vocational-technical core - A required vocational-technical course for all students.
  - Vocational-technical elective - An elective vocational-technical course.
  - Related academic course - An academic course which provides academic skills and knowledge directly related to the program area.
  - Academic core - An academic course which is required as part of the requirements for an Associate degree.
- Description - A short narrative which includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester.

- Prerequisites - A listing of any prerequisite courses that must be taken prior to or on enrollment in the course.
- Competencies and Suggested Objectives - A listing of the competencies (major concepts and performances) and of the suggested student objectives that will enable students to demonstrate mastery of these competencies.

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75 percent of the time allocated to each course. For example, in a four semester hour course consisting of 30 hours lecture and 120 hours of laboratory activities, approximately 22 hours of lecture and 90 hours of lab should be taken by the competencies and suggested objectives identified in the course framework. The remaining 25 percent of each course should be developed at the local district level and may reflect:
  - Additional competencies and objectives within the course related to topics not found in the State framework, including activities related to specific needs of industries in the community college district.
  - Activities which develop a higher level of mastery on the existing competencies and suggested objectives.
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised.
  - Activities which implement components of the Mississippi Tech Prep initiative, including integration of academic and vocational-technical skills and coursework, school-to-work transition activities, and articulation of secondary and postsecondary vocational-technical programs.
  - Individualized learning activities, including worksite learning activities, to better prepare individuals in the courses for their chosen occupational area.

- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

- Programs that offer an Associate of Applied Science degree must include a minimum 15 semester credit hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:

- 3 semester credit hours Math/Science Elective
- 3 semester credit hours Written Communications Elective
- 3 semester credit hours Oral Communications Elective
- 3 semester credit hours Humanities/Fine Arts Elective
- 3 semester credit hours Social/Behavioral Science Elective

It is recommended that courses in the academic core be spaced out over the entire length of the program, so that students complete some academic and vocational-technical courses each semester. Each community/junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- In instances where secondary programs are directly related to community and junior college programs, competencies and suggested objectives from the high school programs are listed as Baseline Competencies. These competencies and objectives reflect skills and knowledge that are directly related to the community and junior college vocational-technical program. In adopting the curriculum framework, each community and junior college is asked to give assurances that:
  - students who can demonstrate mastery of the Baseline Competencies do not receive duplicate instruction, and
  - students who cannot demonstrate mastery of this content will be given the opportunity to do so.

- The roles of the Baseline Competencies are to:
  - Assist community/junior college personnel in developing articulation agreements with high schools, and
  - Ensure that all community and junior college courses provide a higher level of instruction than their secondary counterparts

- The Baseline Competencies may be taught as special "Introduction" courses for 3-6 semester hours of institutional credit which will not count toward Associate degree requirements. Community and junior colleges may choose to integrate the Baseline Competencies into ongoing courses in lieu of offering the "Introduction" courses or may offer the competencies through special projects or individualized instruction methods.

- Technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their area.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

Page

FOREWORD iii

ACKNOWLEDGEMENTS vii

PROGRAM DESCRIPTION 1

SUGGESTED COURSE SEQUENCE 2

SECTION I: BASELINE COMPETENCIES 5

SECTION II: CURRICULUM GUIDE FOR DIESEL EQUIPMENT TECHNOLOGY 15

Diesel Equipment Technology Courses 17
Fundamental of Equipment Mechanics 29
Hydraulic Brake Systems 22
Electrical/Electronic Systems 24
Power Trains 26
Hydraulics 28
Diesel Fuel Systems 30
Preventive Maintenance and Service 32
Engine Rebuilding (Medium/Heavy Duty Applications) 35
Computerized Engine Controls Systems 38
Advanced Brake Systems (Air) 39
Steering and Suspension Systems 42
Air Conditioning and Heating Systems 46
Engine Troubleshooting and Tune-up 49
Auxiliary Systems Components 51
Special Project in Diesel Equipment Technology 53
Supervised Work Experience in Diesel Equipment Technology 54
Welding for Diesel Equipment Technology 55
Transport Refrigeration 56
Fluid Power Trains 58

Related Vocational-Technical Courses 59
Fundamental of Electronics 61

SECTION III: RECOMMENDED TOOLS AND EQUIPMENT 63

APPENDIX A: RELATED ACADEMIC TOPICS A-1

APPENDIX B: WORKPLACE SKILLS B-1

APPENDIX C: STUDENT COMPETENCY PROFILE C-1

DIESEL EQUIPMENT TECHNOLOGY

PROGRAM DESCRIPTION

The Diesel Equipment Technology Program is an instructional program that provides students with competencies required to maintain and repair a variety of industrial diesel equipment, including agricultural tractors, commercial trucks, and construction equipment. The program includes instruction in inspection, repair, and maintenance of engines, power trains, hydraulic systems, and other components.

Postsecondary Diesel Equipment Technology is an articulated two-year certificate or technical program designed to provide advanced skills to its students. Baseline competencies, taken from the secondary Vehicle and Mobile Equipment Mechanics programs, serve as a foundation for the competencies and objectives taught in the courses of the program. Students who do not possess these competencies will be allowed to acquire them during the program. Students who can document mastery of these baseline competencies will not be required to repeat these competencies.

The curriculum framework for postsecondary Diesel Equipment Technology is designed to serve as the core of instruction for approximately seventy-five percent of content of each postsecondary course. The remaining twenty-five percent of each course is to be added at the local level based upon needs of students and local employers.

The curriculum for Diesel Equipment Technology is based upon the *ASE Certification for Medium/Heavy Truck Technician Training Programs*. This document serves as a national standard for certification of medium/heavy truck technician training programs. The tasks described in the document are based on a number of assumptions which also apply to the competencies and objectives in the vocational-technical courses of this program. These assumptions include:

1. In all areas, appropriate theory, safety, and support instruction will be required in the performance of each objective including the identification and safe use of tools and testing and measuring equipment, and the use of reference materials and technical manuals.
2. All diagnostic and repair tasks are performed in accordance with manufacturer's recommended procedures and to manufacturer's specifications.

For additional information on ASE Certification of Medium/Heavy Truck Training Programs, contact the National Automotive Technicians Educational Foundation, 13505 Dulles Technology Drive, Herndon, VA 22071-3415.

DIESEL EQUIPMENT TECHNOLOGY

SUGGESTED COURSE SEQUENCE*

Baseline Competencies for Diesel Equipment Technology**

FIRST YEAR

4 sch	Fundamentals of Equipment Mechanics (DET 1114)	3 sch	Hydraulics (DET 1513)
3 sch	Hydraulic Brake Systems (DET 1213)	3 sch	Diesel Fuel Systems (DET 1313)
3 sch	Electrical/Electronic Systems (DET 1223)	3 sch	Preventive Maintenance and Service (DET 1613)
3 sch	Power Trains (DET 1713)	4 sch	Engine Rebuilding (Medium/Heavy Duty Applications) (DET 1234)
3 sch	Math/Science Elective	3 sch	Oral Communications Elective
16 sch		16 sch	

SECOND YEAR

4 sch	Computerized Engine Controls Systems (DET 2324)	3 sch	Air Conditioning and Heating Systems (DET 2813)
3 sch	Advanced Brake Systems (Air) (DET 2623)	4 sch	Engine Troubleshooting and Tune-up (DET 2244)
3 sch	Suspension & Steering Systems (DET 2253)	3 sch	Vocational-Technical Elective
3 sch	Vocational-Technical Elective	3 sch	Humanities/Fine Arts Elective
3 sch	Written Communications Science Elective	3 sch	Social/Behavioral Science Elective
16 sch		16 sch	

* Students who lack entry level skills in math, English, science, etc., will be provided related studies.

** Baseline competencies are taken from the high school Vehicle and Mobile Equipment Mechanics program. Students who can document mastery of these competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

APPROVED VOCATIONAL-TECHNICAL ELECTIVES

1-3 sch	Special Project in Diesel Equipment Technology (DET 291(1-3))
1-3 sch	Supervised Work Experience in Diesel Equipment Technology (DET 292(1-3))
6 sch	Auxiliary Systems (DET 2236)
2 sch	Introduction to Electronics (EET 1002)
3 sch	Welding for Diesel Equipment Technology (DET 2113)
3 sch	Transport Refrigeration (DET 2823)
3 sch	Fluid Power Trains (DET 2523)
9 sch	Commercial Truck Driving (DTV 1119)

SECTION I:

BASELINE COMPETENCIES

BASELINE COMPETENCIES FOR DIESEL EQUIPMENT TECHNOLOGY

The following competencies and suggested objectives are taken from the publication *Mississippi Curriculum Framework for Vehicle and Mobile Equipment Mechanics*. These competencies and objectives represent the baseline for entrance into the postsecondary Diesel Equipment Technology courses. Students enrolled in postsecondary courses should either (1) have documented mastery of these competencies, or (2) be provided with these competencies before studying the advanced competencies in the Diesel Equipment Technology program.

Baseline competencies may be integrated into existing courses in the curriculum or taught as special "Introduction" courses. The "Introduction" courses may be taught for up to six semester hours of institutional credit and may be divided into two courses. If the Baseline Competencies are to be taught as "Introduction" courses, each course should be at least 3 credit hours. The following course number(s) and description should be used:

Course Name(s): Introduction to Diesel Equipment Technology, Introduction to Diesel Equipment Technology I or Introduction to Diesel Equipment Technology II

Course Abbreviation(s): DET 100(3-6), DET 1013, DET 1023

Classification: Vocational-Technical Core

Description: These courses contain the baseline competencies and suggested objectives from the high school Vehicle and Mobile Equipment Mechanics curriculum which directly related to the community college Diesel Equipment Technology program. The courses are designed for students entering the community college who have had no previous training or documented experience in the field. (3-6 semester hours based upon existing skills for each student. May be divided into 2 course for a maximum total of 6 hours of institutional credit.)

Competencies and Suggested Objectives:

1. Review occupational and leadership opportunities in vehicle and mobile equipment mechanics.
   a. Investigate occupational opportunities in the local area.
   b. Update the student's Career/Educational Plan.
   c. Describe leadership opportunities available from student youth organizations in the school and community, including VICA.

   Related Academic Topics (See Appendix A): C1, C4, C6
   Workplace Skills (See Appendix B): WP2, WP3, WP6

2. Demonstrate safety procedures used in vehicle service.
   a. Apply safety rules for personal and general shop safety including eye, ear, and body protection; general rules of shop conduct; and the use of safety color coding in vehicle shops.
   b. Apply general safety rules for tool and shop equipment use including use of hand tools, air and electric power tools, and other shop equipment.
   c. Apply general safety rules associated with working on various vehicle systems.
   d. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of fire fighting devices.

   Related Academic Topics (See Appendix A): C2, C4, S5, S6, S8
   Workplace Skills (See Appendix B): WP5
3. Demonstrate procedures for handling, storing, and disposing of hazardous materials.
   a. Recognize signal words and symbols that indicate severity of a hazard.
   b. Describe methods for reducing hazardous waste.
   c. Describe procedures for storing hazardous waste.
   d. Interpret data found on a hazardous material safety data sheet.
   e. Describe general safety procedures for first aid and cleanup to follow in case of an accident involving hazardous materials.
   f. Demonstrate procedures for handling, storing, and disposing of hazardous materials.

   Related Academic Topics (See Appendix A): C1, C2, C4, S5, S8
   Workplace Skills (See Appendix B): WP2, WP3, WP4, WP5, WP6
4. Demonstrate safe and proper use and storage of tools and equipment in an vehicle shop.
   a. Identify and demonstrate the safe and proper use of common hand tools including wrenches, sockets, pliers, screwdrivers, striking tools, etc.
   b. Identify and demonstrate the safe and proper use of lifting and hoisting equipment.
   c. Identify and demonstrate the safe and proper use of cleaning equipment.
   d. Identify and demonstrate the safe and proper use of power equipment including impact wrenches, drills, grinders, and presses.
   e. Organize and maintain a systematic storage system for hand and power tools.

   Related Academic Topics (See Appendix A): C2, C4, S8
   Workplace Skills (See Appendix B): WP1, WP5, WP6
5. Locate and apply service specifications and information.
   a. Locate service specifications and information, using both print and computerized service information references.
   b. Interpret and apply information to a specific job on a specific vehicle.

c. Locate and interpret vehicle and major component identification numbers (VIN, certification, and calibration labels).

Related Academic Topics (See Appendix A): C1, C4, M1, M4, S8
Workplace Skills (See Appendix B): WP2, WP5, WP6

6. Demonstrate measurement practices used in vehicle service.
   a. Measure length of an object using a rule to the nearest 1/16th of an inch and nearest millimeter
   b. Measure inside and outside diameter and depth to the nearest .001 of an inch and nearest .1 millimeter, using precision measuring instruments (micrometers, calipers, and dial indicators).

   Related Academic Topics (See Appendix A): M4, S8
   Workplace Skills (See Appendix B): WP2, WP5
7. Identify common fasteners and describe their use.
   a. Identify the different types of bolts, nuts, and washers and describe their appropriate uses.
   b. Identify bolts by grade, diameter, length, and thread pitch.
   c. Identify different glues and sealants used in vehicle and describe their appropriate use.
   d. Restore internal and external threads.

   Related Academic Topics (See Appendix A): C2, M1, M5, S6
   Workplace Skills (See Appendix B): P2, WP5, WP6
8. Identify and describe the major systems and components of a vehicle
   a. Identify the major components and describe their purpose/function of following major systems:
      i. power train
      ii. chassis, steering, and suspension
      iii. fuel
      iv. electrical
      v. cooling
      vi. exhaust
   b. Describe the operation of a four-stroke cycle engine.
   c. Describe the use of electronics and computer control in modern vehicles.

   Related Academic Topics (See Appendix A): C1, C2, C4, S4
   Workplace Skills (See Appendix B): WP2, WP4, WP5
9. Perform lubrication maintenance and general inspection service.
   a. Discuss the importance of regularly scheduled maintenance procedures as outlined in the owners manual and related to vehicle performance and longevity.
   b. Complete a work order and maintenance record for a given vehicle.
   c. Visually inspect the engine lubrication system for leaks and determine needed repairs.
   d. Select proper lubricants and filters for lubrication service.
   e. Change engine oil and filter according to manufacturer's specifications and in accordance with disposal procedures.

f. Perform a chassis and body lubrication.
g. Inspect and service as needed other filters on the engine including air, fuel, pcv valve, crankcase vent filters, etc.
h. Conduct a general preventive maintenance inspection of hoses and belts, fluid levels, wiper blades, headlights and accessory lights, tires, exhaust, shocks, etc; repair/replace/adjust as needed.
i. Clean and service a battery including case, cables and connections, and checking electrolyte level (If applicable). (Maintain electronic memory functions while cleaning.)

Related Academic Topics (See Appendix A): C6, M4, S5, S6, S8
Workplace Skills (See Appendix B): WP1, WP2, WP4, WP5

10. Perform cooling system maintenance.
    a. Drain and refill a cooling system.
    b. Inspect and pressure test a cooling system for proper operation, repair/replace thermostats, hoses, radiator caps, etc as needed.
    c. Test condition and strength of antifreeze/coolant.

    Related Academic Topics (See Appendix A): C4, M1, S5, S6
    Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
11. Perform wheel and tire service.
    a. Identify types and classifications for tires.
    b. Remove and install a wheel assembly to manufacturer's torque specifications.
    c. Inspect tires for proper inflation and abnormal wear.
    d. Dismount, repair, and remount a tire on a wheel.
    e. Balance a tire to industry standards.
    f. Rotate tires following vehicle manufacturer's recommendations.
    g. Diagnose and determine needed repair for abnormal tire wear, to include recognizing symptoms of incorrect camber, caster, and toe alignment.

    Related Academic Topics (See Appendix A): C1, C4, M4, S5, S6
    Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
12. Discuss the operation of brake systems used on heavy equipment and large trucks.
    a. Discuss the operation of a mechanical brake system.
    b. discuss the operation of an air brake system.
    c. discuss the operation of a wet brake system.

    Related Academic Topics (See Appendix A): C1, C2, C4, C6, S6
    Workplace Skills (See Appendix B): WP2, WP4
13. Apply basic electrical principles as related to vehicle circuits.
    a. Describe the flow of electricity in a simple circuit including voltage, amperage, and resistance.
    b. Demonstrate the use of electrical test instruments including multimeters and continuity testers to measure voltage, amperage, and resistance.
    c. Interpret wiring diagrams for a given vehicle circuit including tracing the flow of electricity in the circuit and identifying electrical symbols in the

diagram.

d. Construct a simple DC circuit and test for power and continuity.
e. Diagnose an electrical circuit (horn, turn signal, etc.) for power; repair as needed.

Related Academic Topics (See Appendix A): C2, M1, M4, S6, S8
Workplace Skills (See Appendix B): WP2, WP4, WP5, WP6

14. Perform basic charging and starting system service.
    a. Start a car using jumper cables or auxiliary power supply.
    b. Perform battery capacity (load, high rate discharge) test and determine needed repairs, including slow/fast battery charge.
    c. Remove and replace a battery.
    d. Perform a starter draw test and a starter voltage drop test and determine needed repairs.
    e. Diagnose charging system problems that cause undercharge, overcharge, or no charge condition.
    f. Remove and replace an alternator
    g. Remove and replace a starter.

    Related Academic Topics (See Appendix A): C2, C6, M4, S5, S6, S8
    Workplace Skills (See Appendix B): WP2, WP4, WP5
15. Inspect and evaluate engine mechanical condition.
    a. Describe common parts failures and wear points in a four cycle engine.
    b. Perform a compression test.
    c. Perform a cylinder leakage test.
    d. Diagnose unusual engine noise and vibrations and determine needed actions.
    e. Diagnose unusual exhaust color, odor, and sound; determine needed repairs.

    Related Academic Topics (See Appendix A): C2, C6, M4, S5, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
16. Perform basic service on an engine.
    a. Verify correct camshaft timing; determine needed action.
    b. Grind a valve and valve seat to correct specifications.
    c. Adjust valves on engines with mechanical or hydraulic lifters.

    Related Academic Topics (See Appendix A): C1, C2, M4, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
17. Perform basic service on the fuel system.
    a. Compare the operating principles of a carburetor system to a fuel injection system.
    b. Replace fuel filters according to manufacturer's schedule and procedures.
    c. Inspect and test mechanical and electrical fuel pump and pump control; replace as needed.
    d. Inspect fuel tank and fuel cap; inspect fuel lines, fittings, and hoses; and repair as necessary.
    e. Diagnose fuel system related problems such as hard or no starting, engine

misfire, hesitation, stalling, etc.; determine needed actions.

Related Academic Topics (See Appendix A): C1, C4, M4, S5, S6
Workplace Skills (See Appendix B): WP2, WP4, WP5

18. Perform basic service on a diesel fuel system.
    a. Identify the major components of a diesel fuel system.
    b. Identify the functions of an injector nozzle.
    c. Describe the detrimental effects caused by the presence of water in diesel fuel.
    d. Remove and replace fuel filters.
    e. Bleed air from the system.
    f. Remove, test and adjust, and replace fuel injector nozzles.

    Related Academic Topics (See Appendix A): C1, C4, M4, S5, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
19. Perform basic service on the ignition system.
    a. Compare the operating principles of a conventional (distributor-type) system to an electronic ignition system.
    b. Inspect and test primary and secondary ignition system components including spark plugs and wires; determine needed repairs.
    c. Check and adjust ignition timing as needed.

    Related Academic Topics (See Appendix A): C1, C4, M4, S5, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
20. Perform basic service on the emission control system.
    a. Explain the operating principles of the emission control systems including AIR, heated air induction, early fuel evaporation, EGR, PCV, evaporative emissions, and catalytic converter.
    b. Identify and locate the major components on each system on the vehicle.
    c. Diagnose operation of various components of the computer-controlled engine management system using a hand-held scan tool and multimeter.

    Related Academic Topics (See Appendix A): C4, C6, S5, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
21. Perform basic drive line service/repair.
    a. Inspect, diagnose, and replace universal joints.
    b. Remove and replace axle bearings and seals as needed.
    c. Measure differential backlash using a dial indicator.
    d. Inspect and diagnose constant-velocity (CV) joint noise and vibration problems.
    e. Remove and replace a CV-axle assembly.

    Related Academic Topics (See Appendix A): C4, M4, S6
    Workplace Skills (See Appendix B):WP2, WP4, WP5

22. Perform clutch service.
    a. Remove, inspect, make needed repairs, and reassemble a clutch assembly to include flywheel, pressure plate, disc, and release assembly.
    b. Adjust clutch linkage for free travel.

    Related Academic Topics (See Appendix A): C4, M4, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
23. Perform basic automatic transmission service.
    a. Compare the operation of a conventional transmission to the operation of an electronic transmission, including precautions to be followed in routine service of electronic transmissions.
    b. Service a transmission to include changing fluid and filters.
    c. Visually inspect transmission including checking for leaks and examining condition of fluid.

    Related Academic Topics (See Appendix A): C4, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
24. Perform steering system service.
    a. Describe the procedures for four wheel alignment.
    b. Compare operation of a convention steering system to a rack-and-pinion system.
    c. Inspect components for wear or damage and replace/repair as needed.

    Related Academic Topics (See Appendix A): C4, C6, M4, M5, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
25. Perform suspension system service.
    a. Compare the various types of suspension systems to include conventional, strut-type, and electronic.
    b. Inspect suspension components and determine needed repairs.
    c. Inspect shock absorbers and replace as needed.
    d. Inspect struts and replace as needed.

    Related Academic Topics (See Appendix A): C4, M4, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
26. Perform basic heating system service.
    a. Describe the basic operation of a heater to include the parts and their functions.
    b. Test the operation of the heating system including motor and vacuum controls and determine needed repairs.
    c. Pressure test the system to determine leaks.

    Related Academic Topics (See Appendix A): C4, C6, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
27. Perform basic air conditioning system service.
    a. Describe the basic operation of the air conditioning system to include the parts and their functions.
    b. Test the operation of the air conditioning system including measuring system operating pressure on the high and low sides.

c. Evacuate/discharge an AC system and recharge the system.
d. Check the system for leaks and determine needed repairs.

Related Academic Topics (See Appendix A): C4, C6, S5, S6
Workplace Skills (See Appendix B): WP2, WP4, WP6

28. Perform basic service on a hydraulic system.
    a. Discuss hazards and safety procedures for working with hydraulic systems.
    b. Discuss the operation of a hydraulic system including components and their functions, and operating principles.
    c. Compare the operation of a closed-center and open-center hydraulic system.
    d. Inspect a hydraulic system for leaks and determine needed repairs.

Related Academic Topics (See Appendix A): C1, C2, C4, C6, S6
Workplace Skills (See Appendix B): WP2, WP4, WP5

SECTION II:

CURRICULUM GUIDE

FOR

DIESEL EQUIPMENT TECHNOLOGY

DIESEL EQUIPMENT TECHNOLOGY COURSES

Course Name: Fundamentals of Equipment Mechanics

Course Abbreviation: DET 1114

Classification: Vocational-Technical Core

Description: A course to review and update student skills and knowledge related to safety procedures; tools and equipment usage; handling, storing, and disposing of hazardous materials; operating principles of diesel engines; and selection of fuels, oils, other lubricants, and coolants. (4 sch: 2 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Review safety procedures used in vehicle service.
   a. Apply safety rules for personal and general shop safety including eye, ear, and body protection; general rules of shop conduct; and the use of safety color coding in vehicle shops.
   b. Apply general safety rules for tool and shop equipment use including use of hand tools, air and electric power tools, and other shop equipment.
   c. Apply general safety rules associated with working on various vehicle systems.
   d. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of fire fighting devices.

   Related Academic Topics: C3
   Workplace Skills: WP5, WP6
2. Review procedures for handling, storing, and disposing of hazardous materials, per "Right to Know" laws.
   a. Recognize signal words and symbols that indicate severity of a hazard.
   b. Describe methods for reducing hazardous waste.
   c. Describe procedures for storing hazardous waste.
   d. Interpret data found on a hazardous material safety data sheet.
   e. Describe general safety procedures to follow for first aid and cleanup in case of an accident involving hazardous materials.
   f. Demonstrate procedures for handling, storing, and disposing of hazardous materials.

   Related Academic Topics: C3, C4, C6, S5
   Workplace Skills: WP2, WP5, WP6
3. Review employment opportunities and responsibilities.
   a. Survey employment opportunities in the area.
   b. Report on the responsibilities of an employee in a specific occupational specialty of the equipment technology field.

c. Discuss requirements for obtaining a Commercial Drivers License (CDL) including drug and alcohol screening.

Related Academic Topics: C4, C5, C6
Workplace Skills: WP5, WP6

4. Review measurement techniques, use of special tools and equipment, and use of service and technical manuals.
   a. Measure engine parts using metric and SAE units and using the appropriate instruments; and compare measurements to manufacturer's tolerances for wear.
   b. Identify and describe the use of special tools associated with commercial/industrial type equipment including diesel testing equipment, engine hoisting equipment, engine rebuilding equipment, and commercial/industrial type hand and power tools.
   c. Review procedures for using technical manuals and for locating service information on the vehicle.

   Related Academic Topics: C3, C4, M4, S6
   Workplace Skills: WP4, WP5
5. Review operating principles of gasoline and diesel engines used in commercial/industrial equipment.
   a. Trace the historical development of gasoline and diesel engines with emphasis on recent developments and technologies associated with each engine type.
   b. Identify nomenclature features and their functions peculiar to diesel engines including combustion chambers, cylinder head design, timing gear train, cylinder liners, etc.
   c. Identify the different systems of a diesel engine and describe their operation and function.
   d. Describe the basic operating principles and sequence of a four-stroke diesel engine.
   e. Describe the basic operating principles and sequence of a two-stroke diesel engine.
   f. Identify different types of bearings, seals, and bushings commonly used in a diesel engine and describe their uses.
   g. Describe factors to consider in making decisions on rebuilding or replacing an engine.
   h. Disassemble a diesel engine for component identification purposes.

   Related Academic Topics: C4, C6, S6
   Workplace Skills: WP4, WP5
6. Select appropriate fuels, oils, other lubricants, and coolants for a diesel engine.
   a. Describe how the cetane rating of a diesel fuel affects combustion and operation of an engine.
   b. Identify and describe the use of diesel fuel additives.

c. Describe the API classifications and SAE viscosity ratings for diesel engine oils and how these clarifications and ratings affect engine life and performance.
d. Identify the different types of engine oil and contaminants.
e. Describe the functions and composition of a coolant mixture for a diesel engine, including supplemental coolant additives (SCA's).
f. Identify other lubricants used on a diesel engine including those used in air cleaners, injection pumps, etc.

Related Academic Topics: C4, C6, M1, S5
Workplace Skills: WP4, WP5

Course Name: Hydraulic Brake Systems

Course Abbreviation: DET 1213

Classification: Vocational-Technical Core

Description: A course to develop skills and knowledge related to the diagnosis and repair of hydraulic brake systems. Includes instruction in hydraulic and mechanical systems, power assist units, and anti-lock braking systems. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Perform hydraulic and mechanical brake system repairs.
   a. Diagnose problems caused by the hydraulic system and determine needed repairs.
   b. Depressurize integral high pressure components of a hydraulic brake system following manufacturer's recommended procedures.
   c. Inspect and test a hydraulic brake system, including master cylinder, lines, flexible hoses, valves and fittings, wheel cylinders, and calipers; determine and make needed repairs.
   d. Inspect the mechanical components of the brake system including drums and rotors, pads and shoes, cable linkages, adjuster mechanisms, and mounting hardware; determine and make needed repairs.

   Related Academic Topics: C4, M4, S5, S6
   Workplace Skills: WP4, WP5
2. Perform power assist unit and related component repairs.
   a. Diagnose problems caused by the power brake booster(s); determine and make needed repairs.
   b. Inspect and test the power assist system components including booster(s), hose and control valves, and sensors and lights; adjust or make needed repairs as indicated.
   c. Check emergency (stand-by) hydraulic boost system.

   Related Academic Topics: C4, M4, S5, S6
   Workplace Skills: WP4, WP5
3. Perform anti-lock brake system service and repair.
   a. Diagnose problems caused by anti-lock brake system hydraulic, electrical/electronic, and mechanical components, including using self-diagnostic procedures built into the system.

b. Inspect, test, and service or replace anti-lock brake system hydraulic, electrical/electronic, and mechanical components.

Related Academic Topics: C4, M4, S6
Workplace Skills: WP4, WP5

Course Name: Electrical/Electronic Systems

Course Abbreviation: DET 1223

Classification: Vocational-Technical Core

Description: A course to develop skills and knowledge related to the diagnosis, service, and repair of electrical and electronic systems on diesel engines. Includes instruction in general systems diagnosis, starting and charging system repair, and auxiliary electrical systems repair. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Perform general electrical systems diagnosis.
   a. Use wiring diagrams and test instruments including a test light and multimeter (digital and analog) to check continuity, voltage, voltage drop, resistance, and current flow in a commercial/industrial vehicle; determine needed repairs.
   b. Inspect and test switches, relays, sending units, connectors, wires, and safety devices (fuses, circuit breakers, and fusable links) of vehicle; determine and make needed repairs.
   c. Find shorts, grounds, and opens in an electrical/electronic circuit.
   d. Diagnose key-off battery drain problems.
   e. Inspect and test diodes/resistors; replace as needed.

   Related Academic Topics: C4, M4, S6
   Workplace Skills: WP4, WP5
2. Perform starting and charging system diagnosis and repair.
   a. Compare and contrast the starting system found on industrial/commercial equipment with an automotive starting system.
   b. Diagnose starting system problems, including inspecting and testing relays and solenoids, and conducting a starter free-running (bench) test; determine and make needed repairs.
   c. Diagnose charging system problems including inspecting and testing the voltage regulator, and disassembling, cleaning, and inspecting and testing alternator components; replace/repair as needed.
   d. Diagnose the cause of a no charge, low charge, or overcharge condition; determine and make needed repairs.

   Related Academic Topics: C4, M4, S6
   Workplace Skills: WP4, WP5
3. Perform auxiliary systems diagnosis and repair.
   a. Inspect and test lighting system components (bulbs, switches, connectors and carriers, sockets, relays, fuses, etc.) including headlights, taillights,

turn signals, brake lights, clearance lights, etc.; determine and make needed repairs.

b. Inspect and test gauges and instruments, warning lights, and driver information systems; determine needed repairs.

Related Academic Skills: C4, M4, S6
Workplace Skills: WP4, WP5

Course Name: Power Trains

Course Abbreviation: DET 1713

Classification: Vocational-Technical Core

Description: A course to develop skills and knowledge related to the diagnosis, service, maintenance, and repair of power train units on diesel equipment. Includes instruction on clutch, manual transmissions, drive shafts, and drive axles. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisite: None

Competencies and Student Objectives:

1. Perform clutch diagnosis and repair.
   a. Diagnosis clutch problems and determine needed repairs.
   b. Inspect, adjust, and service as needed the clutch linkage assembly, including all hydraulic components.
   c. Inspect, adjust, and service/replace as needed the clutch assembly including release bearings, sleeve bushings, disc assembly (single and double, push and pull type), and clutch brake.
   d. Inspect, measure, and service/replace the flywheel assembly including the flywheel, ring gear, pins, pilot bearings, and housing.

   Related Academic Topics: C4, M4, S6
   Workplace Skills: WP4, WP5
2. Perform manual transmission diagnosis and repair.
   a. Diagnose transmission problems and determine needed repairs.
   b. Inspect, adjust, and service the transmission remote shift linkage assembly as needed.
   c. Inspect transmission housing and mounts for wear or leakage; repair as needed.
   d. Remove and replace a transmission.
   e. Disassemble a manual transmission; inspect and measure major components (gears, bearings, shafts) for wear; adjust and replace as needed.

   Related Academic Topics: C4, M4, S6
   Workplace Skills: WP4, WP5
3. Perform drive shaft and joint diagnosis and repair.
   a. Diagnose drive shaft and universal joint and vibration problems, and determine needed repairs.
   b. Inspect, service, replace or adjust drive shaft, slip joints, yokes, drive flanges, universal joints, center support bearings and mounts, phasing, and drive line angles.

Related Academic Topics: C4, M4, C6
Workplace Skills: WP4, WP5

4. Perform drive axle diagnosis and repair.
   a. Diagnose drive unit noise, overheating problems, leaks, and vibrations; and determine needed repairs.
   b. Check rear axle drive unit fluid level and condition; determine needed service and add proper type of lubricant.
   c. Disassemble, evaluate, measure, and reassemble differential carrier assembly as needed.
   d. Inspect, adjust, repair, or replace 2-speed axle shift control system, and/or air operated power divider (inter-axle differential) lockout assembly including all related components.
   e. Diagnose rear wheel leaks, bearing noises, and damage; determine and complete needed repairs.

   Related Academic Topics: C4, M4, C6
   Workplace Skills: WP4, WP5

Course Name: Hydraulics

Course Abbreviation: DET 1513

Classification: Vocational-Technical Core

Description: A course to provide instruction and practice in the basic operation and maintenance of hydraulic systems associated with diesel powered equipment. Includes instruction in safety, system operation, seals and cylinders, and filters. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisite: None

Competencies and Suggested Objectives:

1. Explain the operation of a hydraulic system.
   a. Discuss and explain safety procedures necessary in working with hydraulic systems.
   b. Discuss and explain the operation of a hydraulic system including components and their functions, and operating principles.
   c. Draw schematics for and compare/contrast an open center and a closed center hydraulic system which shows the major parts of the system and the direction of flow through the system.
   d. Describe the different types of seals used in hydraulic systems and associate them with their application.
   e. Describe procedures for insuring cleanliness in working with hydraulic systems.
   f. Differentiate between single and double action cylinders.
   g. Identify the different types of filter circuits associated with hydraulic systems.
   h. Identify and describe the function/use of the different types of components associated with hydraulic systems including pumps, valves, hoses, cylinders, and motors.
   i. Distinguish between the different types of hydraulic circuits including series, parallel, and series/parallel.
   j. Identify common symbols used in hydraulic schematics.

   Related Academic Topics: C4, C6
   Workplace Skills: WP4, WP5
2. Test and troubleshoot a hydraulic system.
   a. Test system for flow.
   b. Test system for pressure.
   c. Check system for volume.
   d. Isolate circuits and check for internal leaks of components.
   e. Check for signs of overheating of system.

f. Check for unusual noises, smells/odors, and cavitation.

Related Academic Topics: C4, M4, S6

Workplace Skills: WP4, WP5

3. Perform service on and repair a hydraulic system.
   a. Check condition of hydraulic fluid, filters, lines, and hoses.
   b. Replace filters, clean screens, replace gaskets, o-rings, or seals as needed.
   c. Inspect condition of hydraulic pumps, control valves, and actuators; and replace/repair as needed.
   d. Check system for leaks (external).

   Related Academic Topics: C4, S6, M4

   Workplace Skills: WP4, WP5

Course Name: Diesel Fuel Systems

Course Abbreviation: DET 1313

Classification: Vocational-Technical Core

Description: A course to provide skills and knowledge related to fundamentals of diesel fuel systems operation, maintenance, and repair. Includes instruction in operating principles, general diagnosis and repair, and mechanical fuel injector diagnosis and repair. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Discuss the operation of diesel fuel systems.
   a. Discuss the major components of a diesel fuel system and their functions.
   b. Discuss general maintenance procedures for a diesel fuel system.
   c. Discuss general problems and failures that occur within a diesel fuel system.
   d. Compare the operation of the following diesel fuel systems: common rail, rotary distribution, and in-line.

   Related Academic Topics: C4, C6, S4
   Workplace Skills: WP4, WP5
2. Perform general diagnosis and repair on diesel fuel systems.
   a. Check fuel level, quality, and consumption; determine needed repairs.
   b. Inspect fuel tanks, vents, cap(s), mounts, screens, supply, crossover, and return lines and fittings; determine and make needed repairs.
   c. Inspect, clean, test fuel transfer pump, pump drives, screens, water separators, filters, heaters, and mounting repair; determine and make needed repairs.
   d. Check fuel system for air; determine and make needed repairs.
   e. Prime and bleed fuel system; check primer pump; determine and make needed repairs.
   f. Perform on-engine inspections, including removing, testing, adjusting injectors (and nozzles); determine and make needed repairs.
   g. Inspect high pressure injection and low pressure lines, fittings, and seals; determine and make needed repairs.
   h. Inspect, test, and adjust safety shut-down devices, circuits, and sensors; determine and make needed repairs.

   Related Academic Topics: C4, S6
   Workplace Skills: WP4, WP5

3. Perform mechanical fuel injector diagnosis and repair.
   a. Perform on-engine inspections, tests, and adjustments; check timing or replace and time a distributor (rotary) type injection pump; determine and make needed repairs.
   b. Perform on-engine inspections, tests, and adjustments; check timing or replace and time in-line type injection pump; determine and make needed repairs.
   c. Perform on-engine inspections, tests, and adjustments; replace a PT-type injection pump and injectors as needed.
   d. Perform on-engine inspections, tests, and adjustments; replace and time unit injectors as needed.
   e. Inspect and adjust throttle control linkages; determine and make needed repairs.
   f. Inspect smoke limiters (air/fuel ratio controls); determine and make needed repairs.
   g. Inspect, test, and adjust engine governors; determine needed repairs.
   h. Inspect, test, and adjust engine fuel shut-down devices and controls; determine and make needed repairs.

   Related Academic Topics: C4, S6
   Workplace Skills: WP4, WP5

Course Name: Preventive Maintenance and Service

Course Abbreviation: DET 1613

Classification: Vocational-Technical Core

Description: A course to provide practice in the preventive maintenance of diesel powered equipment. Includes instruction in general preventive maintenance of vehicles and equipment. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Describe procedures for required inspections.
   a. Describe procedures for required inspections of commercial vehicles including state and federal (DOT) requirements.

   Related Academic Topics: C4, C6
   Workplace Skills: WP4, WP5
2. Perform cab and body inspection.
   a. Inspect gauges and indicators for proper operation.
   b. Check DOT safety equipment for availability and condition.
   c. Check accessories for proper operation.
   d. Check condition of interior compartments including seats and upholstery and their operation.
   e. Make visual inspection of cab exterior and body for damage or missing components.
   f. Check air pressure drop.
   g. Compare air pressure build-up time with original equipment specifications.
   h. Check steering wheel free play.
   i. Check pedal and accelerator operation.

   Related Academic Topics: C4, S5
   Workplace Skills: WP4, WP5
3. Perform tire and wheel inspection.
   a. Inspect tires for wear patterns, condition, and air pressure; record tread depth.
   b. Check rim/wheel condition (bends, cracks).
   c. Check spacers, clamps, rings, studs, and nuts for cracks, damage, and indications of looseness.
   d. Check wheel lug nuts for rust, elongation, or wear indicators that would indicate improper torque.
   e. Inspect outer hub seals for oil leaks.
   f. Check wheel bearings for free play.

Related Academic Topics: C4, S5
Workplace Skills: WP4, WP5

4. Perform engine compartment inspection.
   a. Inspect fluid reservoirs for correct levels and condition.
   b. Check engine compartment for leaks (fuel, air, coolant, exhaust).
   c. Check alternator, A/C compressor, starter, engine, and air compressor mounts for tightness and wear.
   d. Check hoses and lines (air, water, fuel, power steering, and A/C) for wear, leaks, and tightness.
   e. Check belts (fan, water pump, alternator, power steering, and A/C) for wear and tension.
   f. Check electrical wiring, routing, and hold-down clamps for wear or damage.
   h. Inspect air intake system (mounts, hoses, clamps, restriction indicators, and turbo) for leaks, damage, and restrictions.
   i. Check other optional equipment for proper operation.
   j. Check A/C condenser, radiator, and after-coolers for air flow restrictions.

   Related Academic Topics: C4, S6
   Workplace Skills: WP4, WP5

5. Perform electrical/electronic inspection.
   a. Inspect condition of batteries, battery boxes, mountings, and hold-downs, and battery cables, ends, looms, relays, and grounds.

   Related Academic Topics: C4
   Workplace Skills: WP4, WP5

6. Perform chassis/undercarriage inspection.
   a. Check manual power steering system and linkages for noises, looseness, binding, hard steering, and fluid leakage.
   b. Inspect front and rear axles and suspension components for wear and damage.
   c. Inspect leak springs, U-bolts, nuts, bushings, shackles, and mounts for looseness and damage.
   d. Inspect air springs, mounts, hoses, and fittings for leaks and damage.
   e. Check transmission mounts; check transmission for leaks and correct fluid levels.
   f. Inspect transmission shift components for leaks and damage.
   g. Inspect driveshaft and yokes for alignment (phasing), wear, and damage.
   h. Inspect brake system air tanks, lines, fittings, valves, brake chambers, and slack adjusters for leaks, damage, and looseness; check all mounting hardware.
   i. Inspect fifth wheel assembly for condition, mounting, and proper operation.

j. Check brake adjustment.
k. Check brake lining condition, wheel seals, drums, and rotors for wear and damage.

Related Academic Topics: C4
Workplace Skills: WP4, WP5

Course Name: Engine Rebuilding (Medium/Heavy Duty Applications)

Course Abbreviation: DET 1234

Classification: Vocational-Technical Core

Description: A course to provide instruction and practice in the rebuilding of diesel engines used in medium to heavy duty commercial applications. Includes instruction in removing and installing engines, disassembly and inspection, and rebuilding of cylinders, heads, pistons, and other parts. (4 sch: 2 hr. lecture, 4 hr. lab)

Prerequisites: None

Suggested Student Objectives:

1. Perform pre-rebuilding activities.
   a. Verify and interpret complaints; determine needed repairs.
   b. Inspect engine assembly for fuel, oil, coolant, and other leaks, identify and determine needed repairs.
   c. Remove engine and prepare for tear down/rebuilding.
   d. Disassemble the engine into the cylinder head assembly and block assembly.

   Related Academic Topics: C4, S6
   Workplace Skills: WP4, WP5
2. Perform cylinder head and valve train diagnosis and repair.
   a. Clean and inspect for visible damage.
   b. Clean and inspect threaded holes, studs, and bolts for serviceability; service or replace as needed.
   c. Inspect cylinder head and mating surfaces for warpage and thickness; inspect for cracks/damages; check condition of passages; inspect core and gallery plugs; determine needed repairs.
   d. Pressure test cylinder head; determine needed repairs.
   e. Inspect and test valve springs for squareness, tension, and free height comparison; replace as needed.
   f. Inspect valve spring retainers and/or rotators and locks; replace as needed.
   g. Measure valve guides for wear, check valve guide-to-stem clearance, and measure valve guide height; replace as needed.
   h. Inspect valves; recondition or replace as needed.
   i. Inspect valve seats; recondition or replace as needed.
   j. Measure valve head height relative to deck, valve face-to-seat contact, and valve seat concentricity; service seats and valves as needed.

k. Inspect injector sleeves and seals; replace; measure injector tip or nozzle protrusion.
l. Clean and inspect precombustion chambers; replace as needed.
m. Inspect valve bridges (crossheads) and guides; replace and adjust bridges as needed.
n. Reassemble cylinder head; vacuum test valve sealing.
o. Inspect, measure, and replace/reinstall overhead camshaft; measure/adjust end play and backlash.
p. Inspect pushrods, rocker arms, rocker arm shafts, and brackets for wear, bending, cracks, looseness, and blocked oil passages; repair or replace as needed.
q. Inspect and adjust cam followers; replace as needed.
r. Adjust valve clearance as needed.

Related Academic Topics: C4, M4, S6
Workplace Skills: WP4, WP5

3. Perform engine block diagnosis and repair.
   a. Inspect pans, covers, gaskets, and seals; replace as needed.
   b. Clean engine block; inspect for cracks; measure mating surfaces for warpage; check condition of passages, core, and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; service or replace as needed.
   c. Pressure test engine block; determine needed repairs.
   d. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed service.
   e. Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed service.
   f. Replace cylinder liners and seals; check and adjust liner height.
   g. Inspect camshaft bearings for wear patterns and damage; determine needed repairs.
   h. Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play.
   i. Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passage(s); check passage plugs; measure journal diameter; determine needed service.
   j. Inspect (for wear patterns) and replace main bearings; check bearing clearances; check and adjust crankshaft end play.
   k. Inspect, replace, and time gear train.
   l. Clean, inspect (for wear patterns), and measure pistons, pins, retainers, and connecting rods; replace as needed.
   m. Measure piston-to-cylinder wall clearance.
   n. Check ring-to-groove clearance and end-gap; install rings on pistons.
   o. Assemble pistons and connecting rods; install in block; replace rod bearings and check clearances.
   p. Check piston cooling jets (nozzles) condition, position, and clearances.

q. Inspect, measure, and service crankshaft vibration damper; replace as needed.
r. Inspect, install, and align flywheel housing.
s. Inspect crankshaft flange and flywheel/flexplate mating surfaces for burrs; measure runouts; repair as needed.
t. Inspect flywheel/flexplate for cracks, wear (includes ring gear), and measure runout; determine needed repairs.

Related Academic Topics: C4, M4, S6
Workplace Skills: WP4, WP5

4. Perform lubrication system diagnosis, service, and repair.
   a. Inspect, measure, and repair oil pump, drives, inlet pipes, and screens; replace as needed.
   b. Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), and filters; repair or replace as needed.
   c. Inspect, clean, test, reinstall/replace, and align oil cooler; test, reinstall/replace differential valve and thermostat; inspect and repair/replace lines and hoses.
   d. Inspect turbocharger lubrication system; determine needed repairs.

   Related Academic Topics: C4
   Workplace Skills: WP4, WP5

5. Perform engine assembly, testing, and installation.
   a. Reassemble the engine cylinder head and engine block assembly.
   b. Perform load (dynamometer) test; determine and make needed adjustments and other repairs.
   c. Reinstall the engine.

   Related Academic Topics: C4, M4, S6
   Workplace Skills: WP4, WP5

Course Name: Computerized Engine Controls Systems

Course Abbreviation: DET 2324

Classification: Vocational-Technical Core

Description: A course to provide skills and knowledge related to the operation, maintenance, and repair of computerized engine control systems. Includes instruction in use of scanning equipment. (4 sch: 2 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Perform computerized engine control system diagnosis and repair.
   a. Inspect and test power and ground circuits and connections; determine needed repairs.
   b. Check DTC (Diagnostic Trouble Codes) from on-board computer system utilizing scan tool and technical information; determine needed repairs.
   c. Inspect and replace electrical connector terminals, seals, and locks.
   d. Inspect and test sensors, controls, and actuator components and circuits; adjust or replace as needed.
   e. Connect computer programming equipment to vehicle/engine; access and change customer parameters; determine needed repairs.
   f. Remove, inspect, test, and reinstall and adjust electronic injectors; determine needed repairs.
   g. Perform cylinder power balance utilizing electronic scan tool.
   h. Perform engine timing sensor adjustment.
   i. Utilizing scan tool, extract engine monitoring information.
   j. Discuss the procedure for downloading and programming an Electrical Control Unit utilizing a PC and a scan tool.

   Related Academic Topics: C4, C6, M4, S6
   Workplace Skills: WP2, WP4, WP5

Course Name: Advanced Brake Systems (Air)

Course Abbreviation: DET 2623

Classification: Vocational-Technical Core

Description: A course to provide instruction and practice in the maintenance and repair of air brake systems commonly used on commercial diesel powered equipment. Includes instruction in maintenance and repair of the air supply system, mechanical system, anti-lock braking system, and traction control system. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: Brakes (DET 1213)

Competencies and Suggested Objectives:

1. Perform air supply and service system diagnosis and repair.
   a. Diagnose problems caused by supply and service system malfunctions; determine needed repairs.
   b. Check air system build-up time; determine and make needed repairs.
   c. Drain air reservoir tanks; check for oil, water, and foreign material; determine and make needed repairs.
   d. Inspect, adjust, and align compressor drive belts, pulleys, and tensioners; replace as needed.
   e. Inspect and time compressor drive gear and coupling; replace as needed.
   f. Inspect air compressor, air cleaner/supply, and oil and water lines and fittings; repair or replace as needed.
   g. Inspect, test, and adjust system pressure controls (governor/relief valve), unloader assembly valves, filters, lines, hoses, and fittings; replace as needed.
   h. Inspect air system lines, hoses, fittings, and couplings; repair or replace as needed.
   i. Inspect, test, and clean air tanks relief (pop-off) valves, one-way check valves, drain cocks, spitter valves, heaters, wiring, and connectors; replace as needed.
   j. Inspect and clean air drier systems, filters, valves, heaters, wiring, and connectors; repair or replace as needed.
   k. Inspect and test brake application (foot) valve, fittings, and mounts; adjust or replace as needed.
   l. Inspect, test, and clean two-way check valves; replace as needed.
   m. Inspect and test stop and parking brake light circuit switches, wiring, and connectors; repair or replace and needed.
   n. Inspect and test hand brake (trailer) control valve, lines, fittings, and mountings; repair or replace as needed.

o. Inspect and test brake relay valve; replace as needed.
p. Inspect and test quick release valve; replace as needed.
q. Inspect and test limiting quick release valve; replace as needed.
r. Inspect and test tractor protection valve; replace as needed.
s. Inspect and test emergency (spring) brake control valve(s) and inversion valve; replace as needed.
t. Inspect and test low pressure warning devices, wiring, and connectors; replace as needed.
u. Inspect and test air pressure gauges, lines, and fittings; replace as needed.

Related Academic Topics: C4, M4, S5, S6
Workplace Skills: WP4, WP5

2. Perform mechanical foundation system diagnosis and repair.
   a. Diagnose problems caused by foundation brake, slack adjuster, and brake chamber problems; determine needed repairs.
   b. Inspect, test, adjust, and service brake chambers, diaphragm, clamp, spring, pushrod, clevis, and mounting brackets; repair or replace as needed.
   c. Inspect and service manual and automatic slack adjusters; adjust or replace as needed.
   d. Inspect cams, rollers, shafts, bushings, seals, spacers, and retainers; service or replace as needed.
   e. Inspect brake spider, shields, anchor pins, bushings, and springs; service or replace as needed.
   f. Inspect wedge brake spider, manual and automatic adjuster plungers, housing, and wedge assembly; repair or replace as needed.
   g. Inspect, clean, and adjust air disc brake caliper assemblies; determine needed repairs.
   h. Inspect brake shoes or pads; replace as needed.
   i. Inspect and measure brake drums or rotors; determine needed repairs.

   Related Academic Topics: C4, M4, S5, S6
   Workplace Skills: WP4, WP5

3. Perform parking brake system diagnosis and repair.
   a. Inspect drive line parking brake drums, rotors, bands, shoes, mounting hardware, and adjusters; adjust, repair, or replace as needed.
   b. Inspect drive line parking brake application system pedal, cables, linkage, levers, pivots, and springs; adjust, repair, or replace as needed.
   c. Check operation of parking (spring) brake chamber; determine needed repairs.
   d. Inspect and test parking (spring) brake check valves, lines, hoses, and fittings; replace as needed.
   e. Inspect and test parking (spring) brake application and release valve; replace as needed.

f. Manually release and rest parking (spring) brakes in accordance with manufacturer's recommendations.

Related Academic Topics: C4, M4, S5, S6
Workplace Skills: WP4, WP5

4. Perform anti-lock brake system diagnosis and repair.
   a. Inspect, test, and service anti-lock brake system (ABS) air, electrical/electronic, and mechanical components.
   b. Diagnose poor stopping, wheel lock-up, pulsation, and noise problems caused by the anti-lock brake system (ABS); determine needed repairs.
   c. Observe anti-lock brake system (ABS) warning light at startup; determine if further diagnosis is needed.
   d. Diagnose anti-lock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine needed repairs.
   e. Service, test, and adjust anti-lock brake system (ABS) speed sensors following manufacturer's recommended procedures.
   f. Discuss the operation of the traction control system as related to anti-lock brakes and engine controls.

   Related Academic Topics: C4, M4, S6
   Workplace Skills: WP4, WP5

Course Name: Steering and Suspension Systems

Course Abbreviation: DET 2253

Classification: Vocational-Technical Core

Description: A course to provide skills and knowledge related to operation, maintenance, and repair of heavy duty steering and suspension systems. Includes instruction in steering column and steering gear, power steering unit, steering linkage, suspension, wheel alignment, and related components diagnosis and repair. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Perform steering column and manual steering gear diagnosis and repair.
   a. Diagnose steering system problems, column and shaft noise, looseness, and binding problems; determine needed repairs.
   b. Inspect steering shaft U-joint(s), slip joints, bearings, bushings, and seals; phase shaft U-joints; replace as needed.
   c. Diagnose manual steering gear noise, binding, uneven turning effort, looseness, hard steering, and lubricant leakage problems; determine needed repairs.
   d. Inspect lubricant for proper type, level, and condition; determine needed service.
   e. Inspect manual steering gear bushings, bearings, shafts, seals, gaskets, and mounting bolts; service, repair, or replace as needed.
   f. Determine enter position (high point) of pitman (cross) shaft; adjust sector shaft lash.

   Related Academic Topics: C4, M4, S6
   Workplace Skills: WP4, WP5
2. Perform power steering system diagnosis and repair.
   a. Diagnose power steering system problems: noises, steering binding, uneven turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems; determine needed repairs.
   b. Inspect power steering fluid type, level, and condition; determine needed service.
   c. Purge power steering system.
   d. Perform power steering system pressure and flow tests; determine needed repairs.
   e. Inspect power steering reservoir including filter, seals, and gaskets; service or replace as needed.

f. Inspect, adjust, and align power steering pump belt(s), pulley(s), and tensioner(s); replace as needed.
g. Inspect power steering pump drive gear and coupling; replace as needed.
h. Inspect power steering pump pressure regulator valves; replace as needed.
i. Inspect power steering system cooler, lines, hoses, and fittings; replace as needed.
j. Inspect and adjust linkage assist-type power steering control and remote relief valves; repair or replace as needed.
k. Inspect and adjust linkage assist-type power steering cylinder; replace as needed.
l. Inspect and adjust integral-type power steering gear, worm gear preload and sector shaft; inspect and adjust poppet valves; repair or replace as needed.
m. Inspect and adjust dual power steering gear systems; replace as needed.
n. Inspect power steering gear, seals, and gaskets; replace as needed.

Related Academic Topics: C4, M4, S6
Workplace Skills: WP4, WP5

3. Perform steering linkage diagnosis and repair.
   a. Inspect pitman arm; replace as needed.
   b. Inspect and adjust drag link and tie rod; replace as needed.
   c. Inspect and adjust drag link and tie rod ends (ball and socket type); replace as needed.
   d. Inspect steering arm and levers and linkage pivot joints; replace as needed.
   e. Inspect and position, as needed, clamps and retainers; replace as needed.
   f. Check steering linkage or wheel stops; adjust as needed.

   Related Academic Topics: C4, S6
   Workplace Skills: WP4, WP5
4. Perform suspension systems diagnosis and repair.
   a. Diagnose ride problems.
   b. Inspect front axles, U-bolts, and nuts; determine needed repairs.
   c. Inspect and service king pin, steering knuckle bushings, locks, bearings, seals, and covers; determine needed repairs.
   d. Inspect shock absorbers, bushings, brackets, and mounts; replace as needed.
   e. Inspect leaf springs, center bolts, clips, eye bolts and bushings, shackles, slippers, insulators, brackets, and mounts; determine needed service and repairs.
   f. Inspect torsion bars, bell cranks, ratchets, bushings, bearings, and mounting brackets; determine needed service and repairs.
   g. Inspect torque arms, bushings, and mounts; determine needed repairs.
   h. Inspect axle aligning devices such as radius rods, track bars, stabilizer bars, and bushings, mounts, shims, and cams; determine needed repairs.

i. Inspect walking beams, center (cross) tube, bushings, mounts, load pads, and saddles/caps; replace as needed.
j. Inspect and test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; adjust, repair, or replace as needed.
k. Inspect and test air springs, mounting plates, springs, suspension arms, and bushings; replace as needed.
l. Measure vehicle frame angle (ride height); determine needed repairs.

Related Academic Topics: C4, M4, S6
Workplace Skills: WP4, WP5

5. Perform wheel alignment diagnosis, adjustment, and repair.
   a. Diagnose vehicle wandering, pulling, shimmy, and hard steering problem(s); adjust and repair as needed.
   b. Discuss procedures for checking and correcting camber and KPI (king pin inclination).
   c. Discuss procedures for checking and correcting caster.
   d. Check toe; adjust as needed.
   e. Check rear axle(s) alignment (thrustline/centerline) and tracking; adjust or repair as needed.
   f. Diagnose turning/Ackerman angle (toe-out-on-turns) problems; determine needed repairs.

   Related Academic Topics: C4, M4, M5, S6
   Workplace Skills: WP4, WP5
6. Perform wheel and tire diagnosis and repair.
   a. Diagnose unusual tire wear patterns; determine needed repairs.
   b. Diagnose wheel/tire vibration, shimmy, pounding, hop (tramp) problems; determine needed repairs.
   c. Inspect wheels, rims, spacers, clamps, studs, and nuts; replace as needed.
   d. Inspect tire and wheel assemblies in accordance with manufacturer's recommended procedures.
   e. Measure wheel and tire radial and lateral runout; adjust and repair as needed.
   f. Discuss static balance of wheel and tire assembly.
   g. Discuss dynamic balance of wheel and tire assembly.
   h. Measure tire diameter; match tires on tandem axle(s).
   i. Clean, inspect, lubricate, and adjust wheel bearings; replace seals and wear rings; replace as needed.

   Related Academic Topics: C4, M4, S6
   Workplace Skills: WP4, WP5
7. Service related components.
   a. Inspect and service fifth wheel assemblies and pintle hitch; determine needed repairs.

b. Inspect frame and frame members for cracks, breaks, distortion (alignment), elongated holes, looseness, and damage; determine needed repairs.
c. Inspect, install, or repair frame, hangers, brackets, and crossmembers.
d. Inspect, test, and adjust cab air suspension components: (lines, hoses, fittings, air springs, bushings, shocks, valves, and linkage); determine needed repairs.
e. Inspect, test, and adjust driver's air seat components; determine needed repairs.
f. Check thrust angle (tracking).
g. Inspect fifth wheel plate and pin (trailer).

Related Academic Topics: C4, M4, S6
Workplace Skills: WP4, WP5

Course Name: Air Conditioning and Heating Systems

Course Abbreviation: DET 2813

Classification: Vocational-Technical Core

Description: A course to provide skills and knowledge related to operation, maintenance, and repair of air conditioning and heating systems used in commercial equipment. Includes instruction in theories and operating principles, A/C system diagnosis and repair, clutch and compressor repair, evaporator and condenser repair, and heating system repair. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: Completion of certification requirements to service and repair air conditioning systems

Competencies and Suggested Objectives:
(NOTE: All practices and procedures must be performed under the direct supervision of an instructor who has been certified to service air conditioning and refrigeration equipment. All practices and procedures must be performed according to current mandates, standards, and regulations.)

1. Identify theories, operating principles, and current regulations related to air conditioner service.
   a. Describe and diagram the flow of refrigerant in an air conditioning system.
   b. Discuss the basic theories of heavy duty air conditioning systems including expansion, pressure-temperature relationship.
   c. Review current mandates, standards, and regulations which are applied to air conditioning system service.

   Related Academic Topics: C4, C6, M4, S5, S6
   Workplace Skills: WP2, WP4, WP5
2. Perform A/C system diagnosis and repair.
   a. Diagnose the cause of unusual operating noises of the A/C system; determine needed repairs.
   b. Identify system type and conduct performance test of the A/C system; determine needed repairs.
   c. Diagnose A/C system problems indicated by refrigerant flow past the sight glass (for systems using a sight glass); determine needed repairs.
   d. Diagnose A/C system problems indicated by pressure gauge readings; determine needed repairs.
   e. Diagnose A/C system problems indicated by visual and touch procedures; determine needed repairs.
   f. Evacuate A/C system.
   g. Clean A/C system components and hoses in accordance with required procedures.

h. Charge A/C system with required refrigerant (liquid or vapor).

Related Academic Topics: C4, M4, S5, S6

Workplace Skills: WP2, WP4, WP5

3. Perform compressor and clutch component diagnosis and repair.
   a. Diagnose A/C system problems that cause the pressure protection devices to interrupt system operation; determine needed repairs.
   b. Inspect A/C system pressure protection devices (including engine fan controls); determine needed repairs.
   c. Inspect and adjust A/C compressor drive belts and pulleys; determine needed repairs.
   d. Inspect and test A/C compressor clutch components or assembly; replace as needed.
   e. Inspect and adjust oil level in A/C compressor.
   f. Inspect and test A/C compressor; replace as needed.
   g. Inspect A/C compressor mountings; repair or replace as needed.

   Related Academic Topics: C4, M4, S5, S6

   Workplace Skills: WP4, WP5
4. Perform evaporator, condenser, and related component diagnosis and repair.
   a. Inspect A/C system mufflers, hoses, lines, filters, fittings, and seals; repair or replace as needed.
   b. Inspect A/C condenser for air flow restrictions; clean and straighten fins.
   c. Inspect, test, and replace A/C system condenser and mountings.
   d. Inspect receiver/drier; replace as needed.
   e. Inspect accumulator/drier in orifice tube A/C systems; replace as needed.
   f. Inspect and test expansion valve; replace as needed.
   g. Inspect and test orifice tube (including filter); replace as needed.
   h. Inspect, test, and clean evaporator; replace as needed.
   i. Inspect and clean evaporator housing and water drain; repair as needed.
   j. Identify and inspect A/C system service valves (gauge connections); replace as needed.
   k. Inspect A/C system high pressure relief device; replace as needed.

   Related Academic Topics: C4, M4, S5, S6

   Workplace Skills: WP4, WP5
5. Perform heating system diagnosis and repair.
   a. Diagnose the cause of temperature control problems in the heater/ventilation/air conditioning system; determine needed repairs.
   b. Diagnose window fogging problems; determine needed repairs.
   c. Perform cooling system tests; determine needed repairs.
   d. Inspect and replace heater system hoses; assure correct routing.
   e. Inspect, test, and replace thermostat, by-pass, and housing.
   f. Inspect and test heater coolant control valve (manual, vacuum, air, or electrical types); replace as needed.
   g. Inspect and flush heater core; replace as needed.

Related Academic Topics: C4, M4, S5, S6
Workplace Skills: WP4, WP5

6. Perform operating system and related controls diagnosis and repair.
   a. Diagnose the electrical and electronic control system of heating, ventilating, and A/C systems; determine needed repairs.
   b. Inspect, test, repair, and replace A/C-heater blower motors, resistors, switches, relay/modules, wiring, and protection devices.
   c. Inspect, test, repair, and replace A/C compressor clutch control devices (relay/modules, wiring, sensors, switches, diodes, and protection devices).
   d. Diagnose the controls of the heating, ventilating, and A/C systems; determine needed repairs.
   e. Inspect, test, and service heating, ventilating, and A/C control panel assemblies; replace as needed.
   f. Inspect, test, and adjust heating, ventilating, and A/C control cables and linkages; replace as needed.
   g. Inspect, test, and adjust heating, ventilating, and A/C ducts, doors, hoses, and outlets; repair or replace as needed.
   h. Diagnose temperature control system problems; determine needed repairs.
   i. Diagnose blower system problems; determine needed repairs.
   j. Diagnose air distribution system problems; determine needed repairs.
   k. Inspect, test, and adjust climate control temperature sensor systems; replace as needed.
   l. Inspect and test heater valve and controls; replace as needed.
   m. Inspect and test electric, vacuum, or air motors, solenoids, and switches; replace as needed.

   Related Academic Topics: C4, M4, S5, S6
   Workplace Skills: WP4, WP5

7. Perform refrigerant recovery, recycling, and handling.
   a. Verify correct operation of refrigerant handling equipment.
   b. Identify and recover A/C system refrigerant.
   c. Recycle refrigerant.
   d. Label and store refrigerant.
   e. Test recycled refrigerant for non-condensable gases.

   Related Academic Topics: C4, M4, S5, S6
   Workplace Skills: WP4, WP5

Course Name: Engine Troubleshooting and Tune-up

Course Abbreviation: DET 2244

Classification: Vocational-Technical Core

Description: A course to provide advanced skills and knowledge related to the diagnosis of problems in the different systems of the diesel engine. Includes instruction in general engine diagnosis and tune-up/service. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: Engine Rebuilding (DET 1224)

Competencies and Suggested Objectives:

1. Perform general engine diagnosis.
   a. Listen to and verify operator's complaint; review past maintenance documents; determine needed repairs.
   b. Inspect fuel, oil, and coolant levels and condition; determine needed repairs.
   c. Inspect engine assembly and compartment for fuel, oil, coolant, air, and other leaks; determine needed repairs.
   d. Interpret engine noises; determine needed repairs.
   e. Check engine exhaust smoke color and quantity; determine needed repairs.
   f. Perform air intake system restriction and/or pressure test; determine needed repairs.
   g. Perform manifold pressure and/or air box pressure tests; determine needed repairs.
   h. Perform exhaust back pressure tests; determine needed repairs.
   i. Perform crankcase pressure test; determine needed repairs.
   j. Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed repairs.
   k. Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed repairs.
   l. Diagnose engine vibration problems; determine needed repairs.
   m. Locate a misfiring cylinder; determine needed repairs.

   Related Academic Topics: C3, C4, M4
   Workplace Skills: WP4, WP5
2. Perform a general engine tune-up and service.
   a. Adjust valve clearance.
   b. Check injector timing; adjust as needed.
   c. Check fuel injection nozzles; adjust as needed.

d. Check injector pump timing and advance; adjust as needed.
e. Check air and fuel filters; replace or service as needed.

Related Academic Topics: C4, M4, S6
Workplace Skills: WP4, WP5

Course Name: Auxiliary Systems Components

Course Abbreviation: DET 2236

Classification: Vocational-Technical Elective

Description: A course to provide advanced skills and knowledge in the repair and service of auxiliary systems on a diesel engine. Includes instruction and practice in servicing and repair of the air induction, air/hydraulic starting, engine brake, and cooling systems. (6 sch: 2 hr. lecture, 8 hr. lab)

Prerequisite: None

Competencies and Suggested Objectives:

1. Perform air induction and exhaust systems diagnosis and repair.
   a. Inspect air induction piping, air cleaner, and element; service or repair as needed.
   b. Inspect turbocharger, and waste gate/engine driven blowers and piping systems; determine needed repairs.
   c. Remove and reinstall turbocharger and waste gate/engine driven blowers.
   d. Inspect intake manifold, gaskets, and connections; repair or replace as needed.
   e. Inspect, clean, and test aftercooler (intercooler) and charge air cooler assemblies; repair or replace as needed.
   f. Inspect exhaust manifold, piping, mufflers, and mounting hardware; repair or replace as needed.
   g. Inspect preheater (glow plug) system and controls; repair or replace as needed.
   h. Inspect ether/starting fluid system and controls; repair or replace as needed.
   i. Inspect emergency air induction shut-off system; repair or replace as needed.

   Related Academic Topics: C4, M4, S5
   Workplace Skills: WP4, WP5
2. Perform air-powered and hydraulic-powered starting system diagnosis and repair.
   a. Discuss operating principles of air-powered starting systems.
   b. Discuss operating principles of hydraulic-powered starting systems.

   Related Academic Topics: C4, M4, S5
   Workplace Skills: WP4, WP5
3. Perform engine brake system diagnosis and repair.
   a. Inspect and adjust engine brakes; determine needed repairs.

b. Inspect, test, and adjust engine brake control circuits, switches, and solenoids; repair or replace as needed.
c. Inspect engine brake housing, valves, seals, screens, lines, and fittings; repair or replace as needed.

Related Academic Topics: C4, M4, S5
Workplace Skills: WP4, WP5

4. Perform cooling system diagnosis and repair.
   a. Check engine coolant level, condition, and consumption; determine needed repairs.
   b. Check coolant temperature, gauge, and sending unit.
   c. Inspect drive belts and tensioners; reinstall or replace and adjust as needed.
   d. Inspect thermostat, by-passes, housing(s), and seals; replace as needed.
   e. Test conditioner and coolant concentration levels; determine needed adjustments.
   f. Flush and refill cooling system; bleed air from system.
   g. Inspect coolant conditioner/filter, check valves, lines, and fittings; replace as needed.
   h. Inspect water pump, hoses, and idler pulley; repair or replace as needed.
   i. Inspect, clean, and pressure test radiator, pressure cap, and tank(s) and recovery systems; determine needed repairs.
   j. Inspect fan hub, fan, fan clutch, controls, thermostat, and fan shroud; repair or replace as needed.
   k. Inspect radiator shutter assembly and controls; repair or replace as needed.

Related Academic Topics: C4, M4, S5, S6
Workplace Skills: WP4, WP5

Course Name: Special Project in Diesel Equipment Technology

Course Abbreviation: DET 291(1-3)

Classification: Vocational-Technical Elective

Description: A course to provide students with practical application of skills and knowledge related a specific instructor-approved topic. Instructor and student work closely together in planning and conducting the project. (1-3 sch: 2-6 hr. lab)

Prerequisites: Consent of the instructor

Competencies and Suggested Objectives:

(Specific objectives for this course will be developed by the instructor and student and used for assessment of student learning.)

Related Academic Topics: To be determined by local instructor
Workplace Skills: To be determined by local instructor

Course Name: Supervised Work Experience in Diesel Equipment Technology

Course Abbreviation: DET 292(1-3)

Classification: Vocational-Technical Elective

Description: A supervised on-site work experience in which the student works under the supervision of industry and community college personnel. Competencies and objectives for this course are determined by a mutual agreement between the student, employer, and teacher. (1-3 sch: 2-6 hr. lab)

Prerequisites: Consent of the instructor

Competencies and Suggested Objectives:

Related Academic Topics: To be determined by local instructor
Workplace Skills: To be determined by local instructor

Course Name: Welding for Diesel Equipment Technology

Course Abbreviation: DET 2113

Classification: Vocational-Technical Elective

Description: A basic course in welding and cutting techniques for diesel equipment mechanics. Includes instruction in fundamental procedures and safety, oxyacetylene welding and cutting, shielded metal-arc welding, and metal inert gas welding procedures. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Demonstrate fundamental procedures related to welding.
   a. Demonstrate welding safety practices related to personal safety.
   b. Identify and demonstrate the use of hand and shop tools used in welding
   c. Discuss basic principles related to welding.
   Related Academic Topics: C6, S6
   Workplace Skills: WP4, WP5
2. Demonstrate oxyacetylene welding, brazing, and cutting procedures.
   a. Set up and adjust oxyacetylene welding and cutting equipment.
   b. Cut mild steel plate.
   c. Weld mild steel plate using a filler rod.
   d. Braze mild steel plate.
   Related Academic Topics: S5
   Workplace Skills: WP4, WP5
3. Demonstrate shielded metal-arc welding procedures.
   a. Set up and adjust shielded metal arc welding equipment.
   b. Construct a flat butt weld.
   c. Construct a horizontal butt weld.
   d. Construct a vertical butt weld.
   Related Academic Topics: S5
   Workplace Skills: WP4, WP5
4. Demonstrate metal inert gas (MIG) welding procedures.
   a. Set up and adjust MIG welding equipment.
   b. Construct a flat butt weld on mild steel plate.
   c. Construct a horizontal butt weld.
   d. Construct a vertical butt weld.
   Related Academic Topics: S5
   Workplace Skills: WP4, WP5

Course Name: Transport Refrigeration

Course Abbreviation: DET 2823

Classification: Vocational-Technical Elective

Description: A course to provide skills and knowledge related to service and repair of transport refrigeration units. Includes instruction on operating principles, common refrigeration unit problems, and refrigeration unit repairs. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:
(NOTE: All practices and procedures must be performed under the direct supervision of an instructor who has been certified to service air conditioning and refrigeration equipment. All practices and procedures must be performed according to current mandates, standards, and regulations.)

1. Discuss the operation of the transport refrigeration system.
   a. Identify and locate the components of the system.
   b. Explain the relationship between pressure and temperature of a refrigerant.
   c. Complete diagrams showing flow paths and state of refrigerant in heating and cooling cycles.
   d. Explain the differences in the heat and defrost cycles.
   e. Test the operation of the unit in all modes.
   Related Academic Topics: C4, C6, M4, S5, S6
   Workplace Skills: WP2, WP4, WP5
2. Diagnose common refrigeration unit problems using recommended procedures, including reduced heating or cooling capacity, no heat, no cooling, no defrost, and stuck in defrost.
   a. Review safety and environmental precautions for unit operation, refrigerants, installation of gauges, and low side and high side pump-downs.
   b. Demonstrate tests for solenoid valve and pilot solenoid operation.
   c. Demonstrate initiation of manual defrost.
   d. Test relay contacts and armature windings.
   e. Demonstrate the use of high-side and low-side pump-downs to prove integrity of compressor valves, check valves, and three-way valve.
   f. Check refrigerant charge and compressor oil level.
   Related Academic Topics: C4, M4, S5, S6
   Workplace Skills: WP4, WP5

3. Perform refrigerant system and control circuit repairs.
   a. Locate and repair refrigerant leaks.
   b. Perform tubing solder joint repairs.
   c. Repair/replace solenoid valves or check valves.
   d. Remove/replace relays.
   e. Replace belts and drive couplings.
   f. Remove and replace compressor.
   g. Replace filter/drier.
   h. Demonstrate use of refrigerant reclamation/recycling equipment.
   i. Demonstrate evacuation and charging procedure.

   Related Academic Topics: C4, S5, S6
   Workplace Skills: WP4, WP5
4. Service microprocessor controlled refrigeration units.
   a. Discuss the use of microprocessor controls in transport refrigeration units.
   b. Perform a pre-trip inspection of a microprocessor controlled refrigeration unit to include downloading and interpreting data.

   Related Academic Topics: C4, C6, S5, S6
   Workplace Skills: WP2, WP4, WP5

Course Name: Fluid Power Trains

Course Abbreviation: DET 2523

Classification: Vocational-Technical Elective

Description: A course to provide skills and knowledge related to the maintenance and repair of fluid power trains used on heavy equipment. Includes instruction in general principles of operation and diagnosis and repair of system components. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Describe general principles of operation as applied to fluid power transmissions.
   a. Describe the general principles of operation as applied to fluid power transmissions.
   b. Identify the major components of a fluid power transmission and describe their functions.

   Related Academic Topics: C4, C6, S6
   Workplace Skills: WP4, WP5
2. Perform diagnosis and repair on torque converters.
   a. Perform on-vehicle service for a torque converter, including inspecting for leaks and changing lubricant and filters.
   b. Dismount, disassemble, inspect, and repair torque converters.

   Related Academic Topics: C4, S6
   Workplace Skills: WP4, WP5
3. Perform diagnosis, service, and repair on power-shift transmissions.
   a. Perform on-vehicle service for a power-shift transmission including inspecting for leaks, testing for pressure, and changing lubricant and filters.
   b. Dismount, disassemble, inspect, and repair a power-shift transmission.

   Related Academic Topics: C4, S6
   Workplace Skills: WP4, WP5
4. Perform diagnosis and repair on hydrostatic transmissions.
   a. Perform on-vehicle service for a hydrostatic transmission, including inspecting for leaks, testing for pressure, and changing lubricant and filters.
   b. Dismount, disassemble, inspect, and repair a hydrostatic transmission.

   Related Academic Topics: C4, S6
   Workplace Skills: WP4, WP5

RELATED VOCATIONAL-TECHNICAL COURSES

Course Name: Fundamentals of Electronics

Course Abbreviation: EET 1102

Classification: Related Vocational-Technical Elective (from Electricity/Electronics/ Related Engineering Cluster)

Description: A course designed to provide fundamental skills associated with all electronics courses. It includes safety, breadboarding, use of calculator, test equipment familiarization, soldering, electronic symbols, and terminology. (2 sch: 1 hr. lecture, 2 hr. lab)

Prerequisite: None

Competencies and Suggested Student Objectives:

1. Explain, demonstrate, and practice general safety procedures in the shop, lab, and industrial environments.
   a. Apply proper safety techniques for all types of circuits and components.
   b. Demonstrate an understanding of and comply with relevant OSHA safety standards.
2. Demonstrate and utilize proper breadboarding techniques.
   a. Identify the various schematic symbols.
   b. Identify the various resistor and capacity codes.
   c. Layout a breadboard by the use of a schematic.
   d. Demonstrate forming components to fit into a breadboard.
   e. Demonstrate techniques for selecting and forming wires to make connections.
3. Demonstrate proficiency in the use of a calculator.
   a. Use SI symbols and prefixes to describe electrical values.
   b. Manipulate numbers in mathematical operations using scientific notation, engineering notation, and E notation to aid in mathematical circuit analysis.
   c. Perform basic algebraic operations using electronic equations to express the rules of symbol transformation.
   d. Perform basic trigonometry to include Pythagorean Theorem, sine function, cosine function, and tangent function.
   e. Perform practical math in solving ratio, percentage, propriations, powers, and roots of numbers on digital conversions.
4. Demonstrate the proper use and operation of test equipment.
   a. Demonstrate the use and care of test instruments including volt-ohm meters, current meters, and oscilloscopes.
   b. Explain the cause and effects of current and voltage circuit loading.
   c. Describe the differences between analog and digital multimeters.

d. Discuss the advantages and disadvantages of analog and digital multimeters.
e. Explain zeroing the ohmmeter prior to use and effects of battery drain on its accuracy.
f. Demonstrate proper troubleshooting techniques by use of selected meters.

5. Demonstrate proper soldering and desoldering techniques.
   a. Apply acceptable soldering/desoldering techniques, including thru-bole and surface mount devices.
   b. Apply acceptable standards of proper solderless connections.

SECTION III:

RECOMMENDED TOOLS AND EQUIPMENT

RECOMMENDED TOOLS AND EQUIPMENT FOR DIESEL EQUIPMENT TECHNOLOGY

1. Student Tool Kit (1 kit per 2 students)
   a. Adjustable wrenches (2) 6" and 12"
   b. Allen wrench sets - standard (.050" - 3/8") and metric (2mm - 7mm)
   c. Brake spoon
   d. Chisels - cape (5/16") and cold (3/8" & 3/4")
   e. Claw type pickup tool
   f. Combination wrench sets - standard (1/4" - 1") and metric (7mm - 19 mm)
   g. Continuity test light (12v)
   h. Feeler gauge (blade type) .002" - .040 " and .006 mm - .070 mm
   i. Hack saw
   j. Hammer - 16 oz. ball peen
   k. Hammer - plastic tip
   l. Ignition wrench set - US and metric
   m. Magnetic pickup tool
   n. Pliers - combination 6", locking jaw, needle nose, side cutting, and slip joint (water pump)
   o. Punches - center, brass drift, pin (1/8", 3/16", 1/4", 5/16") , and taper (3/8", 1/2", 5/8")
   p. Scrapers - carbon 1" and gasket 1"
   q. Screwdrivers - standard (stubby, 6", 9", 12", and offset) and Phillips (stubby #1, #2; 6" #1, #2; 12" #3)
   r. Screw starters - standard and Phillips
   s. Socket set - 1/4" drive - 1/4"-1/2" standard sockets, 1/4"-1/2" deep sockets, 6mm-12mm standard sockets, 6mm-12mm deep sockets, flex/universal type handle, 3" and 6" extensions, ratchet
   t. Socket set - 3/8" drive - 5/16"-3/4" standard sockets; 3/8"-3/4" deep sockets; 9mm-19mm standard sockets; 9mm-19mm deep sockets; 3", 6", 12", and 18" extensions; flexhead ratchet; ratchet; speed handle; universal joint; spark plug sockets (5/8" & 13/16")
   u. Socket set - 1/2" drive - 7/16" - 1 1/8" standard sockets; 7/16" - 1 1/8" deep sockets; 10mm-25mm standard sockets; 10mm-25mm deep sockets; 3",6", and 12" extensions; flex/universal type handle, ratchet
   v. Socket set - 3/4" drive
   w. Spark plug feeler gauge (gap tool)
2. Air blow gun (OSHA approved) (2 per program)
3. Air/hydraulic floor jack (heavy duty, minimum capacity-20 tons) (1 per program)
4. Air/hydraulic floor jack (medium duty, minimum capacity-5-10 tons) (2 per program)
5. Battery post cleaner (2 per program)

6. Battery terminal pliers (2 per program)
7. Battery terminal puller (2 per program)
8. Files - coarse 6"&12", fine 6"&12", half-round 12", and round 6" & 12" (2 sets per program)
9. Flare nut (tubing wrenches) 3/8" - 3/4" and 10mm - 17mm (1 per program)
10. Flashlight (1 per program)
11. Hammer - dead blow plastic mallet (2 per program)
12. Jumper wire set (2 per program)
13. Pliers - hose clamp (2 per program)
14. Pry bars - rolling head and straight (2 sets per program)
15. Screwdriver set - Posidrive® #1-#4 (1 set per program)
16. Screwdriver set - Torx® T-8 - T-55 (2 sets per program)
17. 3/8" drive air ratchet (2 per program)
18. 3/8" drive impact sockets (US and metric) (2 per program)
19. 3/8" drive impact wrench (2 per program)
20. 3/8" drive flexible socket set (US and metric) (4 per program)
21. 1/2" drive air impact wrench (2 per program)
22. 1/2" drive impact sockets (US and metric) (2 per program)
23. 3/4" drive air impact wrench (1 per program)
24. 3/4" drive impact sockets (US and metric) (1 set per program)
25. 1" drive air impact wrench (1 per program)
26. 1" drive impact sockets (US and metric) (1 set per program)
27. Air chisel with various bits (1 per program)
28. Air compressor and hoses (1 per program)
29. Torque wrenches - 1/4", 3/8", 1/2" and 3/4" drive (1 each per program)
30. Axle stands (heavy duty - minimum 1 ton capacity) (1 set per service bay)
31. 2 or 4 post above ground lift (1 per program)
32. Hydraulic power puller set (minimum capacity 10 tons) (1 per program)
33. Battery charger/booster starter (2 per program)
34. Belt tensioner gauge (1 per program)
35. Bench or pedestal grinder (2 per program)
36. Compression tester (universal-type for use with both diesel and gasoline engines.) (1 per program or 1 gasoline type and 1 diesel type per program)
37. Cooling system pressure tester (1 per program)
38. Floor creeper (1 per service bay)
39. Cylinder leakage tester (1 per program)
40. Dial indicator with flex arm and clamp base (2 per program)
41. Digital multimeter with various leadsets (2 per program)
42. Drain pans (1 per service bay)
43. Drill - 3/8" variable speed (2 per program)
44. Drill - 1/2" variable speed (2 per program)
45. Engine hoist (heavy duty) (2 per program, 1 overhead and 1 crane-type)
46. Extension cords (1 per service bay)
47. Fender covers (2 sets per program)

48. Gear lube dispenser (1 per program)
49. Hand held vacuum pump (1 per program)
50. High pressure washer (1 per program)
51. Hot plate (or equivalent) (1 per program)
52. Hydraulic bottle jacks (minimum capacity - 20 tons) (2 per program)
53. Hydraulic press with adapters (minimum capacity-25 ton) (1 per program)
54. Jumper cables (commercial/industrial duty) (2 per program)
55. Master puller set (1 per program)
56. Microcomputer with monitor, printer, CD-ROM drive and cables (1 per program)
57. Outside micrometers (0-1", 1-2", 2-3", 3-4", 4-5", 5-6", 6-7") (1 set per program)
58. Oil can - pump type (1 per program)
59. Oil filter wrench(es) (1 set-various sizes)
60. Parts cleaning tank (1 per program)
61. Parts cleaning tank (hot-type, EPA approved) (1 per program)
62. Parts cleaner - blast bead type (1 per program)
63. Remote starter switch (1 per program)
64. Screw extractor set (2 per program)
65. Seat covers (2 sets per program)
66. Sledges - 8lb. and 16 lb. (1 each per program)
67. Snap ring pliers set - external and internal (2 per program)
68. Soldering gun (1 per program)
69. Soldering iron (25 watt pencil type) (1 per program)
70. Spark plug boot puller (1 per program)
71. Steel top workbenches with vises (1 per service bay)
72. Tach/dwell meter (1 per program)
73. Tap and die set (US and metric - heavy duty, industrial grade) (1 set per program)
74. Thread repair insert kit (1 per program)
75. Tire inflator chuck (2 per program)
76. Trouble/work lights (1 per service bay)
77. Tube quick disconnect tool set (1 per program)
78. Tubing cutter and flaring set (1 per program)
79. Twist steel drill bit set (1/64" - 1") 2 sets per program
80. Twist steel drill bit set (1mm-25mm)
81. Valve core removal tool (2 per program)
82. Vernier calipers (0-6" and 0-125mm) (1 set per program)
83. Waste oil receptacle (1 per program)
84. Ball joint press (1 per program)
85. Bearing packer (1 per program)
86. Brake pedal holder (1 per program)
87. Drag link tool (1 per program)
88. Inner tie rod end tool (1 per program)

71

89. Pitman arm puller(1 per program)
90. Shock absorber tools (1 set per program)
91. Spring/strut compressor tool (1 per program)
92. Tie rod puller (1 per program)
93. Tire mounting machine (heavy duty commercial truck type) (1 per program)
94. Wheel balancer (heavy duty commercial truck type) (1 per program)
95. Wheel weight pliers (1 per program)
96. Brake bleeder, pressure (1 per program)
97. Brake cylinder clamps (1 per program)
98. Brake disc micrometer (1 per program)
99. Brake drum micrometer (1 per program)
100. Brake lathe with disc service attachments (1 per program)
101. Brake shoe adjusting gauge (1 per program)
102. Brake spring installers (1 per program)
103. Brake spring pliers (1 per program)
104. Asbestos containment/removal device (1 per program)
105. Refrigerant recovery/recycling machine (r-12 and HFC-134a) (1 each per program or machine capable of handling both)
106. A/C service port adapter set (2 per program)
107. A/C compressor tool set (2 per program)
108. Mainfold gauge set (2 per program)
109. Transport refrigeration tool set (2 per program)
110. Refrigerant lead detector tool (2 per program)
111. Antifreeze tester (1 per program)
112. Battery/starter/charging system tester (heavy duty) (1 per program)
113. Carburetor plug and angle gauge set (1 per program)
114. Computer carburetor tools (1 per program)
115. Oxygen sensor socket (1 per program)
116. Sending unit socket (1 per program)
117. Spark plug thread tap (1 per program)
118. Static strip (6 per program)
119. Timing advance light (1 per program)
120. Vacuum/pressure gauge set (1 per program)
121. Transmission jack(s) (heavy duty) (1 per program)
122. Transmission holding fixtures (1 per program)
123. Transmission special tools set (truck and commercial vehicle type) (2 sets per program - various manufacturers)
124. Alternator service tools (1 per program)
125. Connector pick tool set (1 per program)
126. Wire and terminal repair kit (2 sets per program - various manufacturers)
127. Clutch alignment set (1 per program)
128. Clutch pilot puller set (1 per program)
129. Universal joint tools (1 per program)
130. Valve and valve seat resurfacing equipment (1 per program)

131. Valve guide repair unit (1 per program)
132. Valve spring compressor (1 per program)
133. Valve spring tester (1 per program)
134. Dial bore gauges (1 set per program - various sizes)
135. Cylinder hones (1 set per program - various sizes)
136. Cam bearing installation tool (1 per program)
137. Crankshaft v-blocks (1 per program)
138. Engine pre-oiler (1 per program)
139. Cylinder liner pullers (1 per program)
140. Protusion gauge (1 per program)
141. Precision straight edge 4' (1 per program)
142. Piston ring compressor tools (1 set per program - various sizes)
143. Magnetic crack detector (1 per program)
144. Axle bearing nut set (1 set per program - various sizes)
145. U-joint puller (1 per program)
146. Hydraulic pressure testing equipment (1 per program)
147. Diesel fuel injector nozzle pop tester (1 per program)
148. King pin honing machine (1 per program)
149. Dynamometer (800 hp minimum for inframe and out of frame testing) (1 per program)
150. Electronic controlled heavy duty diesel engine (1 per program)
151. Diagnostic equipment for electronically controlled diesel engines (1 per program)
152. Jig timing tool set (1 per program)
153. Tune-up tool sets for diesel (2 sets per program - various manufacturers)
154. U-tube manometer (1 per program)
155. Digital pyrometer (1 per program)
156. Electronic terminal crimping tool and terminal assortment (1 per program)
157. 7-way trailer cord connector tester (1 per program)
158. Heavy duty drill press (1 per program)
159. Oxy/acetylene welding and cutting set (1 per program)
160. Shielded metal arc welder (1 per program)
161. Metal inert gas (MIG) welder (1 per program)

INSTRUCTIONAL AIDS AND RESOURCES

1. Microcomputer service information software (CD-ROM)
2. DOT Inspection Books (10 per program)
3. TV/monitor
4. VCR
5. TV/VCR cart

APPENDIX A:

RELATED ACADEMIC TOPICS

APPENDIX A

RELATED ACADEMIC TOPICS FOR COMMUNICATIONS

C1 Interpret written material.
C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
C3 Listen, comprehend, and take appropriate actions.
C4 Access, organize, and evaluate information.
C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.

EXPANDED TOPICS FOR COMMUNICATIONS

TOPIC C1: Interpret written material.

C1.01 Read and follow complex written directions.
C1.02 Recognize common words and meanings associated with a variety of occupations.
C1.03 Adjust reading strategy to purpose and type of reading.
C1.04 Use sections of books and reference sources to obtain information.
C1.05 Compare information from multiple sources and check validity.
C1.06 Interpret items and abbreviations used in multiple forms.
C1.07 Interpret short notes, memos, and letters.
C1.08 Comprehend technical words and concepts.
C1.09 Use various reading techniques depending on purpose for reading.
C1.10 Find, read, understand, and use information from printed matter or electronic sources.

TOPIC C2: Interpret visual materials (maps, charts, graphs, tables, etc.).

C2.01 Use visuals in written and in oral presentations.
C2.02 Recognize visual cues to meaning (layout, typography, etc.).
C2.03 Interpret and apply information using visual materials.

TOPIC C3: Listen, comprehend, and take appropriate action.

C3.01 Identify and evaluate orally-presented messages according to purpose.
C3.02 Recognize barriers to effective listening.
C3.03 Recognize how voice inflection changes meaning.
C3.04 Identify speaker signals requiring a response and respond accordingly.
C3.05 Listen attentively and take accurate notes.
C3.06 Use telephone to receive information.

C3.07 Analyze and distinguish information from formal and informal oral presentations.

TOPIC C4: Access, organize, and evaluate information.

C4.01 Distinguish fact from opinion.
C4.02 Use various print and non-print sources for specialized information.
C4.03 Interpret and distinguish between literal and figurative meaning.
C4.04 Interpret written or oral communication in relation to context and writer's point of view.
C4.05 Use relevant sources to gather information for written or oral communication.

TOPIC C5: Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.

C5.01 Select appropriate words for communication needs.
C5.02 Use reading, writing, listening, and speaking skills to solve problems.
C5.03 Compose inquiries and requests.
C5.04 Write persuasive letters and memos.
C5.05 Edit written reports, letters, memos, and short notes for clarity, correct grammar, and effective sentences.
C5.06 Write logical and understandable statements, phrases, or sentences for filling out forms, for correspondence or reports.
C5.07 Write directions or summaries of processes, mechanisms, events, or concepts.
C5.08 Select and use appropriate formats for presenting reports.
C5.09 Convey information to audiences in writing.
C5.10 Compose technical reports and correspondence that meet accepted standards for written communications.

TOPIC C6: Communicate ideas and information using oral and written forms for a variety of audiences and purposes.

C6.01 Give complex oral instructions.
C6.02 Describe a business or industrial process/mechanism.
C6.03 Participate effectively in group discussions and decision making.
C6.04 Produce effective oral messages utilizing different media.
C6.05 Explore ideas orally with partners.
C6.06 Participate in conversations by volunteering information when appropriate and asking relevant questions when appropriate.
C6.07 Restate or paraphrase a conversation to confirm one's own understanding.
C6.08 Gather and provide information utilizing different media.

C6.09 Prepare and deliver persuasive, descriptive, and demonstrative oral presentations.

RELATED ACADEMIC TOPICS FOR MATHEMATICS

M1 Relate number relationships, number systems, and number theory.
M2 Explore patterns and functions.
M3 Explore algebraic concepts and processes.
M4 Explore the concepts of measurement.
M5 Explore the geometry of one-, two-, and three-dimensions.
M6 Explore concepts of statistics and probability in real world situations.
M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

EXPANDED TOPICS FOR MATHEMATICS

TOPIC M1: Relate number relationships, number systems, and number theory.

M1.01 Understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, and scientific notation) in real world and mathematical problem situations.
M1.02 Develop number sense for whole numbers, fractions, decimals, integers, and rational numbers.
M1.03 Understand and apply ratios, proportions, and percents in a wide variety of situations.
M1.04 Investigate relationships among fractions, decimals, and percents.
M1.05 Compute with whole numbers, fractions, decimals, integers, and rational numbers.
M1.06 Develop, analyze, and explain procedures for computation and techniques for estimations.
M1.07 Select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods.
M1.08 Use computation, estimation, and proportions to solve problems.
M1.09 Use estimation to check the reasonableness of results.

TOPIC M2: Explore patterns and functions.

M2.01 Describe, extend, analyze, and create a wide variety of patterns.
M2.02 Describe and represent relationships with tables, graphs, and rules.
M2.03 Analyze functional relationships to explain how a change in one quantity results in a change in another.
M2.04 Use patterns and functions to represent and solve problems.
M2.05 Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations.

M2.06 Use a mathematical idea to further their understanding of other mathematical ideas.
M2.07 Apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, and business.

TOPIC M3: Explore algebraic concepts and processes.

M3.01 Represent situations and explore the interrelationships of number patterns with tables, graphs, verbal rules, and equations.
M3.02 Analyze tables and graphs to identify properties and relationships and to interpret expressions and equations.
M3.03 Apply algebraic methods to solve a variety of real world and mathematical problems.

TOPIC M4: Explore the concepts of measurement.

M4.01 Estimate, make, and use measurements to describe and compare phenomena.
M4.02 Select appropriate units and tools to measure to the degree of accuracy required in a particular situation.
M4.03 Extend understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass.
M4.04 Understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs.

TOPIC M5: Explore the geometry of one-, two-, and three-dimensions.

M5.01 Identify, describe, compare, and classify geometric figures.
M5.02 Visualize and represent geometric figures with special attention to developing spatial sense.
M5.03 Explore transformations of geometric figures.
M5.04 Understand and apply geometric properties and relationships.
M5.05 Classify figures in terms of congruence and similarity and apply these relationships.

TOPIC M6: Explore the concepts of statistics and probability in real world situations.

M6.01 Systematically collect, organize, and describe data.
M6.02 Construct, read, and interpret tables, charts, and graphs.
M6.03 Develop an appreciation for statistical methods as powerful means for decision making.
M6.04 Make predictions that are based on exponential or theoretical probabilities.

M6.05 Develop an appreciation for the pervasive use of probability in the real world.

TOPIC M7: Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

M7.01 Use computers and/or calculators to process information for all mathematical situations.
M7.02 Use problem-solving approaches to investigate and understand mathematical content.
M7.03 Formulate problems from situations within and outside mathematics.
M7.04 Generalize solutions and strategies to new problem situations.

RELATED ACADEMIC TOPICS FOR SCIENCE

S1 Explain the Anatomy and Physiology of the human body.
S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
S3 Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.
S4 Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.
S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

EXPANDED TOPICS FOR SCIENCE

TOPIC S1: Explain the Anatomy and Physiology of the human body.

S1.01 Recognize common terminology and meanings.
S1.02 Explore the relationship of the cell to more complex systems within the body.

S1.03 Summarize the functional anatomy of all the major body systems.
S1.04 Relate the physiology of the major body systems to its corresponding anatomy.
S1.05 Compare and contrast disease transmission and treatment within each organ system.
S1.06 Explore the usage of medical technology as related to human organs and organ systems.
S1.07 Explain the chemical composition of body tissue.

TOPIC S2: Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.

S2.01 Identify the major types and structures of plants, viruses, monera, algae protista, and fungi.
S2.02 Explain sexual and asexual reproduction.
S2.03 Describe the ecological importance of plants as related to the environment.
S2.04 Analyze the physical chemical and behavioral process of a plant.

TOPIC S3: Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.

S3.01 Explain the morphology, anatomy, and physiology of animals.
S3.02 Describe the characteristics, behaviors, and habitats of selected animals.

TOPIC S4: Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.

S4.01 Examine minerals and their identification, products of the rock cycle, byproducts of weathering, and the effects of erosion.
S4.02 Relate the Hydrologic Cycle to include groundwater its zones, movement, and composition; surface water systems, deposits, and runoff.
S4.03 Consider the effects of weather and climate on the environment.
S4.04 Examine the composition of seawater; wave, tides, and currents; organisms, environment, and production of food; energy, food and mineral resources of the oceans.

TOPIC S5: Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.

S5.01 Examine the science of chemistry to include the nature of matter, symbols, formulas and nomenclature, and chemical equations.
S5.02 Identify chemical reactions including precipitation, acids-bases, and reduction-oxidation.
S5.03 Explore the fundamentals of chemical bonding and principles of equilibrium.
S5.04 Relate the behavior of gases.
S5.05 Investigate the structure, reactions, and uses of organic compounds; and investigate nuclear chemistry and radiochemistry.

TOPIC S6: Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.

S6.01 Examine fundamentals of motion of physical bodies and physical dynamics.
S6.02 Explore the concepts and relationships among work, power, and energy.
S6.03 Explore principles, characteristics, and properties of electricity, magnetism, light energy, thermal energy, and wave energy.
S6.04 Identify principles of modern physics related to nuclear physics.

TOPIC S7: Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance; population genetics, the structure and function of DNA, and current applications of DNA technology.

S7.01 Examine principles, techniques, and patterns of traits and inheritance in organisms.
S7.02 Apply the concept of population genetics to both microbial and multicellular organism.
S7.03 Identify the structure and function of DNA and the uses of DNA technology in science, industry, and society.

TOPIC S8: Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

S8.01 Apply the components of scientific processes and methods in classroom and laboratory investigations.
S8.02 Observe and practice safe procedures in the classroom and laboratory.
S8.03 Demonstrate proper use and care for scientific equipment.
S8.04 Investigate science careers, and advances in technology.
S8.05 Communicate results of scientific investigations in oral, written, and graphic form.

APPENDIX B:

WORKPLACE SKILLS

APPENDIX B
WORKPLACE SKILLS FOR THE 21ST CENTURY

WP1 Allocates resources (time, money, materials and facilities, and human resources).

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

WP5 Selects, applies, and maintains/troubleshoots technology.

WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.

APPENDIX C:

STUDENT COMPETENCY PROFILE

STUDENT COMPETENCY PROFILE

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each course. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the program.

In the blank before each competency, place the date on which the student mastered the competency.

Fundamental of Equipment Mechanics (DET 1114)

_____ 1. Review safety procedures used in vehicle service.
_____ 2. Review procedures for handling, storing, and disposing of hazardous materials, per "Right to Know" laws.
_____ 3. Review employment opportunities and responsibilities.
_____ 4. Review measurement techniques, use of special tools and equipment, and use of service and technical manuals.
_____ 5. Review operating principles of gasoline and diesel engines used in commercial/industrial equipment.
_____ 6. Select appropriate fuels, oils, other lubricants, and coolants for a diesel engine.

Hydraulic Brake Systems (DET 1213)

_____ 1. Perform hydraulic and mechanical brake system repairs.
_____ 2. Perform power assist unit and related component repairs.
_____ 3. Perform anti-lock brake system service and repair.

Electrical/Electronic Systems (DET 1223)

_____ 1. Perform general electrical systems diagnosis.
_____ 2. Perform starting and charging system diagnosis and repair.
_____ 3. Perform auxiliary systems diagnosis and repair.

Power Trains (DET 1713)

_____ 1. Perform clutch diagnosis and repair.
_____ 2. Perform manual transmission diagnosis and repair.
_____ 3. Perform drive shaft and joint diagnosis and repair.
_____ 4. Perform drive axle diagnosis and repair.

Hydraulics (DET 1513)

_____ 1. Explain the operation of a hydraulic system.
_____ 2. Test and troubleshoot a hydraulic system.
_____ 3. Perform service on and repair a hydraulic system.

Diesel Fuel Systems (DET 1313)

_____ 1. Discuss the operation of diesel fuel systems.
_____ 2. Perform general diagnosis and repair on diesel fuel systems.
_____ 3. Perform mechanical fuel injector diagnosis and repair.

Preventive Maintenance and Service (DET 1613)

_____ 1. Describe procedures for required inspections.
_____ 2. Perform cab and body inspection.
_____ 3. Perform tire and wheel inspection.
_____ 4. Perform engine compartment inspection.
_____ 5. Perform electrical/electronic inspection.
_____ 6. Perform chassis/undercarriage inspection.

Engine Rebuilding (Medium/Heavy Duty Applications) (DET 1234)

_____ 1. Perform pre-rebuilding activities.
_____ 2. Perform cylinder head and valve train diagnosis and repair.
_____ 3. Perform engine block diagnosis and repair.
_____ 4. Perform lubrication system diagnosis, service, and repair.
_____ 5. Perform engine assembly, testing, and installation.

Computerized Engine Controls Systems (DET 2324)

_____ 1. Perform computerized engine control system diagnosis and repair.

Advanced Brake Systems (Air) (DET 2623)

_____ 1. Perform air supply and service system diagnosis and repair.
_____ 2. Perform mechanical foundation system diagnosis and repair.
_____ 3. Perform parking brake system diagnosis and repair.
_____ 4. Perform anti-lock brake system diagnosis and repair.

Steering and Suspension Systems (DET 2253)

_____ 1. Perform steering column and manual steering gear diagnosis and repair.

_____ 2. Perform power steering system diagnosis and repair.
_____ 3. Perform steering linkage diagnosis and repair.
_____ 4. Perform suspension systems diagnosis and repair.
_____ 5. Perform wheel alignment diagnosis, adjustment, and repair.
_____ 6. Perform wheel and tire diagnosis and repair.
_____ 7. Service related components.

Air Conditioning and Heating Systems (DET 2813)

_____ 1. Identify theories, operating principles, and current regulations related to air conditioner service.
_____ 2. Perform A/C system diagnosis and repair.
_____ 3. Perform compressor and clutch component diagnosis and repair.
_____ 4. Perform evaporator, condenser, and related component diagnosis and repair.
_____ 5. Perform heating system diagnosis and repair.
_____ 6. Perform operating system and related controls diagnosis and repair.
_____ 7. Perform refrigerant recovery, recycling, and handling.

Engine Troubleshooting and Tune-up (DET 2244)

_____ 1. Perform general engine diagnosis.
_____ 2. Perform a general engine tune-up and service.

Auxiliary Systems Components (DET 2236)

_____ 1. Perform air induction and exhaust systems diagnosis and repair.
_____ 2. Perform air-powered and hydraulic-powered starting system diagnosis and repair.
_____ 3. Perform engine brake system diagnosis and repair.
_____ 4. Perform cooling system diagnosis and repair.

Special Project in Diesel Equipment Technology (DET 291(1-3))

Supervised Work Experience in Diesel Equipment Technology (DET 292(1-3))

Welding for Diesel Equipment Technology (DET 2113)

_____ 1. Demonstrate fundamental procedures related to welding.
_____ 2. Demonstrate oxyacetylene welding, brazing, and cutting procedures.
_____ 3. Demonstrate shielded metal-arc welding procedures.
_____ 4. Demonstrate metal inert gas (MIG) welding procedures.

Transport Refrigeration (DET 2823)

_____ 1. Discuss the operation of the transport refrigeration system.
_____ 2. Diagnose common refrigeration unit problems using recommended procedures, including reduced heating or cooling capacity, no heat, no cooling, no defrost, and stuck in defrost.
_____ 3. Perform refrigerant system and control circuit repairs.
_____ 4. Service microprocessor controlled refrigeration units.

Fluid Power Trains (DET 2523)

_____ 1. Describe general principles of operation as applied to fluid power transmissions.
_____ 2. Perform diagnosis and repair on torque converters.
_____ 3. Perform diagnosis, service, and repair on power-shift transmissions.
_____ 4. Perform diagnosis and repair on hydrostatic transmissions.

Fundamentals of Electronics (EET 1102)

_____ 1. Explain, demonstrate, and practice general safety procedures in the shop, lab, and industrial environments.
_____ 2. Demonstrate and utilize proper breadboarding techniques.
_____ 3. Demonstrate proficiency in the use of a calculator.
_____ 4. Demonstrate the proper use and operation of test equipment.
_____ 5. Demonstrate proper soldering and desoldering techniques.